SIEMENS

SIMATIC

Process Control System PCS 7
Time synchronization (V7.1)

Function Manual

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

> ### ⚠ DANGER
> indicates that death or severe personal injury **will** result if proper precautions are not taken.

> ### ⚠ WARNING
> indicates that death or severe personal injury **may** result if proper precautions are not taken.

> ### ⚠ CAUTION
> with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

> ### CAUTION
> without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

> ### NOTICE
> indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

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Note the following:

> ### ⚠ WARNING
> Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Table of contents

Preface

<div style="text-align: right; font-size: 3em;">1</div>

Purpose of this documentation

The *time synchronization* documentation provides support for the configuration and commissioning of the "time synchronization" function in a PCS 7 plant.

The documentation provides information about the following topics:

- Time synchronization in a PCS 7 plant
- Planning time synchronization in a PCS 7 plant
- Configuring time synchronization for a PCS 7 plant

> **Note**
>
> You will find information on high-precision time stamping in the function manual *PCS 7 Process Control System; High-precision time stamping*.

Organization

The documentation is organized according to the following topics:

- Fundamentals of time synchronization mode of operation in a PCS 7 plant
- Configuration possibilities of PCS 7 with time synchronization
- Planning a PCS 7 plant with time synchronization
- Configuring the time synchronization for different plant configurations

Target group and benefit

This documentation is intended for personnel working in the fields of sales, planning, and configuration:

Target group	Using the documentation	Target-group relevant chapters of the documentation
Sales	Sales personnel give clear advice to their customers on implementing the "time synchronization" function in a PCS 7 plant.	• "Fundamentals" • "Configurations for time synchronization of a PCS 7 plant" • "Planning time synchronization"
Planning	The system planner uses the information in the documentation for optimal set up and the components necessary in this regard for planning a PCS 7 plant with the "time synchronization function".	• "Fundamentals" • "Configurations for time synchronization of a PCS 7 plant" • "Planning time synchronization"
Configuration	The configuration engineer is provided with exact instructions relative to the "time synchronization" function; these instructions show the specific steps that are necessary to adjust the time synchronization at all relevant points.	• "Configuring time synchronization"

Skills required

Only qualified personnel should commission and operate the PCS 7 products.
Skills in the following areas are prerequisite:

- STEP 7
- PCS 7
- "Automation technology"
- Basic WinCC skills
- For plants with domain structure: Knowledge of the Windows administration

Validity

This documentation is valid for the software package *Process Control System; PCS 7 Toolset* V7.1 or higher.

Fundamentals

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2.1   Using time synchronization in PCS 7

Introduction

Plants in which Process Control Systems are used contain numerous components that exchange data. Most plants require time synchronization for controlling processes and information. There are additional requirements in terms of the documentation of event sequences.

If the timing of components in the overall system is not synchronized, these tasks can only be supported by the internal clock of the individual components.

Components that are equipped with an internal hardware clock (RTC = Real Time Clock) include:

- Domain servers
- Servers
- Clients
- PC stations
- Automation systems
- I/O
- Sensors
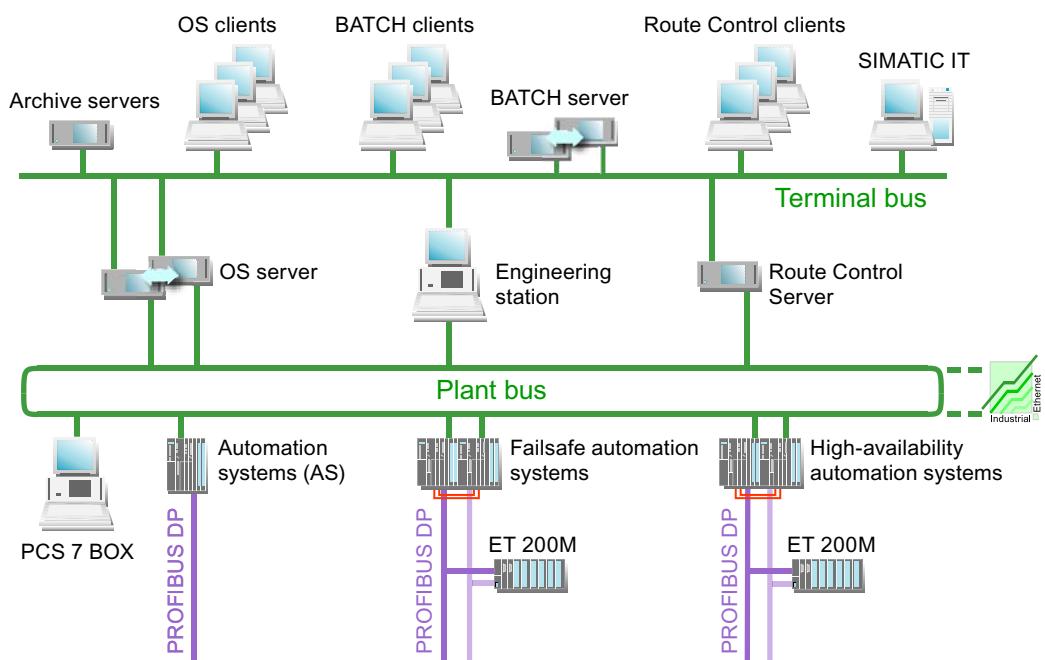
Time synchronization

Time synchronization means that one system component (time master) provides a precise time for all the other components (time slaves). The time information (date and time) can either be distributed by the time master, or be requested by the time slaves. For the overall task, all components within the system must evaluate this time information.

Time synchronization applications

The list below contains various examples of aspects requiring time synchronization of all components within the process automation:

- Synchronizing processes
- Controlling complex sequences
- Logging and documenting sequences
- Validating processes
- Analyzing processes
- Analyzing the causes and effects of events

PCS 7 functions

The following list contains some of the key PCS 7 functions for which time synchronization is absolutely necessary:

- Interpretation of causal relationships
- Message processing in correct sequence
- Time stamp
- Time-of-day interrupts
- Runtime meter
- Redundancy compare
- Batch monitoring
- Authentication of a domain client

2.2 Time synchronization options for PCS 7 components

Time synchronization for PCS 7 components

The table below shows the PCS 7 components for which time synchronization is possible:

Station	Time synchronization	For further information, refer to the section ...
Operator station	• Via the terminal bus • Via the plant bus	• "How to set time synchronization on an OS in a domain with central time master. (Page 79)" • "How to set time synchronization on an OS in a work group with central time master (Page 72)"
BATCH station	• Via the operating system	• "How to make DCF 77 Client Service settings on a PC station without OS (Page 93)" • "How to set time synchronization on a BATCH/operator station. (Page 95)"
Route Control Station	• Via the operating system	• "How to make DCF 77 Client Service settings on a PC station without OS (Page 93)" • "How to set time synchronization on a route control/operator station. (Page 95)"
SIMATIC PCS 7 BOX	• At integration in a PCS 7 plant	• "Configuring time synchronization for the SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX (Page 109)"
AS	• Via the plant bus	• "How to set AS time synchronization (Page 99)"
Domain controller	• With a domain controller as time master on the terminal bus	• "How to set time synchronization in a Windows domain with a central time master (Page 40)" • "How to set time synchronization in a Windows domain without a central time master (Page 42)"

V5-compatible mode

> **Note**
>
> Contact Customer Support if you want to use time synchronization in V5-compatible mode.

2.3 Time displayed in PCS 7

Coordinated Universal Time (UTC)

Coordinated Universal Time (UTC) is an international time basis that takes as its precedent the precision of atomic clocks. UTC refers to the Greenwich prime meridian in London.

UTC does not take daylight saving time into account.

Local time

East of the prime meridian, one or more hours is added to the universal time measured in Greenwich, depending on the distance in question. West of the prime meridian, the hours are subtracted.

The following table shows some examples of time zones and their time differences in relation to UTC:

Location	Time zone	Zone time	Time
Greenwich	0. Longitude	UTC = Coordinated Universal Time	UTC 12:00
Berlin	15. Eastern longitude	CET = Central European Time	UTC + 1h: 13:00
Moscow	45. Eastern longitude	MSK = Moscow Time	UTC + 3h: 15:00
Tokyo	120. Eastern longitude	JST = Japan/Korea Standard Time	UTC + 9h: 21:00
Buenos Aires	45. Western longitude	No designation	UTC – 3h: 9:00

Daylight saving time/standard time

A number of countries have introduced conversion of standard time (local time) to daylight saving time for the summer months.

Example:
In central Europe, standard time differs by plus one hour, while daylight saving time differs by plus two hours in relation to standardized universal time (UTC).

UTC	CET standard time	CEST daylight saving time
12:00	UTC + 1h = 13:00	UTC + 2h = 14:00

Time display in process mode

In PCS 7, the operator can toggle the time displayed on the operator station between UTC and local time while the plant is in process mode. The operator station can display the local time, including daylight saving time and standard time.

Note

If time-dependent data of different time zones is displayed or processed on a PCS 7 component, then use UTC for display on the operator station as well.

2.4 Time synchronization in distributed PCS 7 plants

Introduction

PCS 7 supports system configurations where subcomponents are installed at different locations, or even in different time zones. An example would be the installation of an automation system and an operator station at different locations. The time must be synchronized for the entire PCS 7 plant in order to optimize the sequence of all the processes.

In PCS 7, the times of subcomponents are directly synchronized within a time zone. PCS 7 uses the "time synchronization" function to synchronize different time zones.

Time response in distributed PCS 7 plants

The following figure shows that time jumps may occur in process control systems (for example, in the alarm lists) if there is no time synchronization. The processes do not run synchronously:
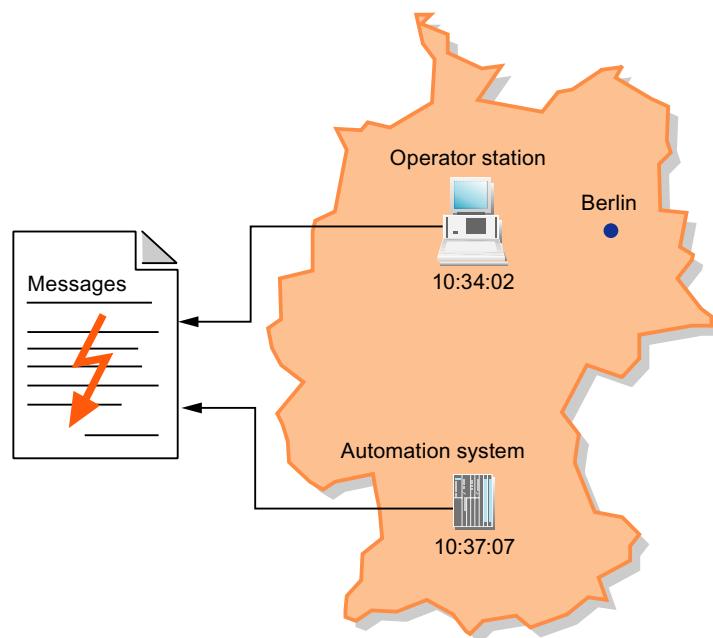
If the times for the components of a distributed PCS 7 plant are synchronized, all of the processes will run in correct chronological order and will be archived correctly.
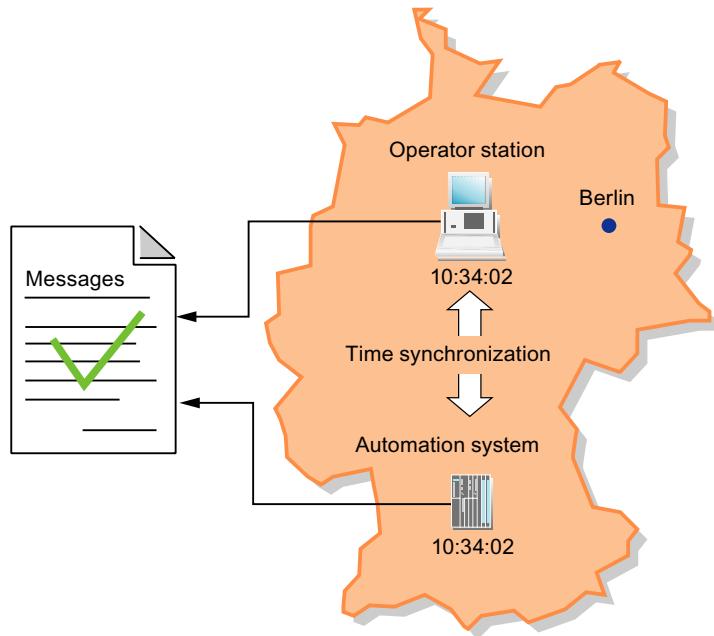
Rules for configuring distributed PCS 7 plants

Since PCS 7 plants generally operate on the basis of UTC **internally**, their specific components can be distributed on a global scale. In order to safeguard the interplay of components - even across different time zones - please observe the following:

- Use UTC as the common time base in all PCS 7 plants. All plant components running with UTC will display the same time after time synchronization.

- Set up a PC station as a PCS 7 Web server in all PCS 7 plants, using the PCS 7 OS web option. This will allow you to access the PCS 7 Web servers of the PCS 7 plants via multiple Web clients (in PCS 7: WebNavigator client or WebNavigator diagnostic client) at the company's headquarters. You can convert the time display on the Web client to the local system time. Please note the resulting time difference.

- If monitoring a PCS 7 plant in a different time zone on an OS, you can convert the time displayed from UTC to the local system time using the OS control panel. Please note the resulting time difference.
  Note the following to prevent external synchronization:

NOTICE
Time message frames from external networks
Time message frames from external networks must be prevented from infiltrating process control systems that are distributed across several networks or connected to the Intranet or Internet.
Always connect the company network and the plants using network components that enable separation of time signals, e.g. a router. Configure those network components so that forwarding of time message frames is blocked.

Further information

- Section "Setting the time displayed (Page 51)"
- WinCC online help

2.5 Central plant clock

Using a central plant clock

You should always synchronize all Process Control Systems using either a precise time or a standard time. In the case of PCS 7 plants, we recommend performing synchronization by means of a central plant clock. The central plant clock manages the time centrally for the entire plant and synchronizes all of the other plant components via their interfaces.

Recommendation:
Using the SICLOCK TC 400 as the central plant clock. The SICLOCK should be synchronized with a standard time, e.g. using GPS or DCF 77, as this ensures that a correct reference to the actual time is constantly available.

Standard time

The following standard times are typical for PCS 7 plants:

- GPS
  The GPS signal is provided by a global satellite system.

- DCF 77
  The DCF 77 signal is available in Germany and in certain parts of Europe using corresponding radio signal receivers.

2.6 Time levels for a PCS 7 plant (stratum)

Introduction

Time synchronization of a system involves one component synchronizing the next component by forwarding a time message frame. Forwarding time message frames will result in time delays. You should make allowances for this fact when setting up a PCS 7 plant.

The following figure shows an example of the structure of a PCS 7 plant with several domains:
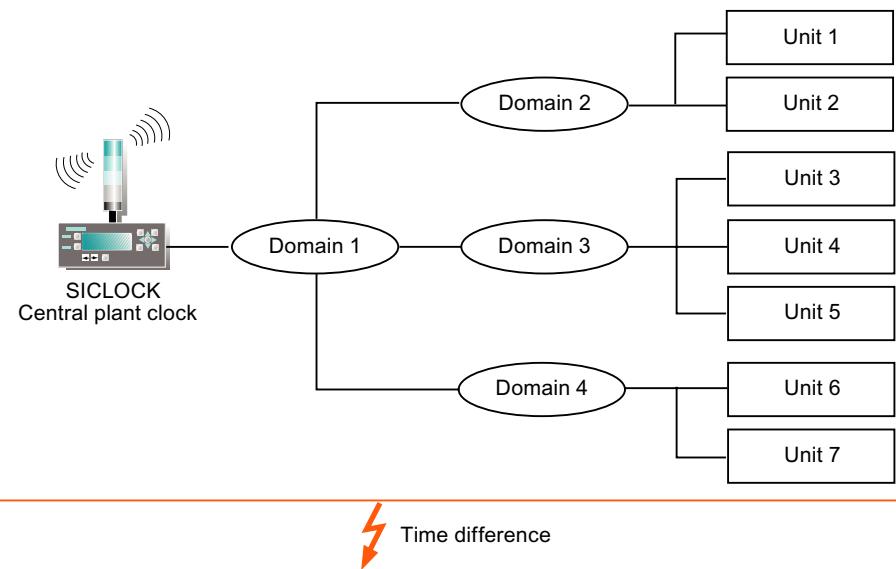
Definition stratum

A PCS 7 plant component such as the central time clock (SICLOCK) receives the definitive time from an external time source (e.g. a GPS signal) and forwards it to other components to be synchronized. As a result, the SICLOCK is the time master for those components whose time is determined in relation to the SICLOCK time. Components which are capable of providing a time are considered time masters if other components use their time information.

All time masters form a hierarchy that consists of higher-level and lower-level time masters. Relative position within this hierarchy is designated with a number; the "stratum". Multiple time masters may be located within a single stratum. These time masters use the time message frame at the same point in time to synchronize their own clock.

The stratum indicates the following:

- The number of time levels between the stratum in which the time master is located and the stratum in which the time source (e.g. the GPS satellite) is located

- The time level where the components in a network are located

Time synchronization using strata

The following figure shows an example of time synchronization using strata:
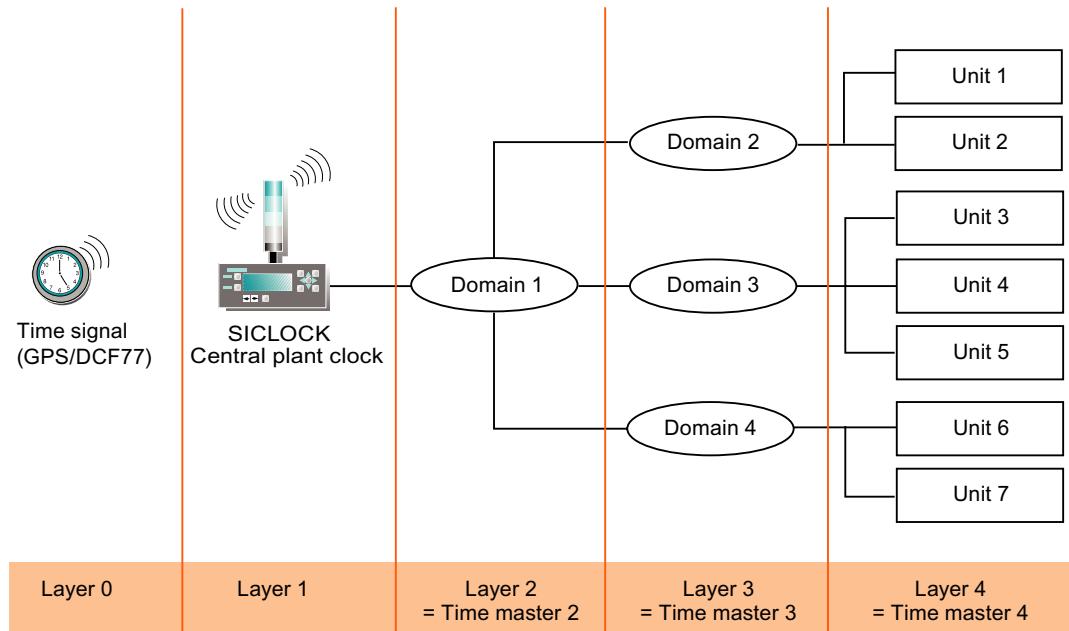
The above example shows time synchronization with the following structure:

- Stratum 0
  The time source is an atomic clock. This atomic clock synchronizes the GPS satellites or the DCF 77 senders, for example.

- Stratum 1
  The central plant clock (SICLOCK) receives the time via a radio signal (e.g. GPS decoder or DCF 77 receiver). SICLOCK transfers the time to domain controller 1 in stratum 2.

- Stratum 2
  Domain controller 1 is the time slave of the central plant clock. Domain controller 1 transfers the time to several domain controllers in stratum 3. Domain controller 1 is the time master of the domain controllers in stratum 3.

- Stratum 3
  The domain controllers in stratum 3 synchronize the time of their own process units in stratum 4. The domain controllers in stratum 3 are the time masters of their own process units.

- Stratum 4
  The process unit components are time slaves.

Meaning of the strata for a PCS 7 plant

The higher the stratum level, the higher the potential time difference in relation to the original time signal source. As time forwarding in a network also takes time, the time of lower strata time masters is more precise than the time of higher strata time masters.

Rules for planning a PCS 7 plant taking strata into account

Please observe the following rules when planning time synchronization, to ensure that the time deviation of the time master is not too high in relation to the components in the lowest stratum:

● Use as few strata as possible.

● In most cases using a maximum of four strata is recommended.

● Use the same strata for the same structure elements.

When planning a PCS 7 plant to be synchronized, you should define exactly which hierarchy would be best for receiving and forwarding the time.

2.7 Time synchronization in PCS 7 - mode of operation

2.7.1 Time master and time slave

Introduction

To ensure that all Process Control System components operate with as precise a time as possible, one system component must be the time source for all other components. The precise time must be permanently available and be used for synchronization on a cyclical basis (synchronization interval).

Time master

The component that provides the precise time within a bus system is referred to as the time master. Only one component within a stratum can be the active time master.

Time slave

The time slaves within a bus system are components which receive or fetch their time from a time master.

Cooperative time master

On OS servers, in the WinCC Editor "Time Synchronization" permanently defined computers are set for the time synchronization.
The OS server works as a cooperative time master, i.e. the first active OS server on the plant bus which does not receive time message frames on the plant bus automatically switches to time "Master" mode. All other OS servers on the plant bus detect the time message frame from the time master and automatically switch to time "slave" mode.

A cooperative time master does not have to belong to a redundant server.

Note

This setting applies both for the configuration with and without a central time master (central plant clock e.g. SICLOCK TC 400).

Function of the cooperative time master

The following process is initiated at the startup of a PC station that is configured as a cooperative time master. A time message frame must be received within the wait time once the PC station has powered up. The wait time amounts to four times the set synchronization interval.

Possible response of cooperative time masters within the phase until the wait time has expired:

- A cooperative time master that receives a time message frame from a different time master within the wait time becomes a time slave.

- A cooperative time master that has not received a time message frame on expiry of the wait time sends time message frames as the time master.

Within the set synchronization interval, all cooperative time masters check whether time message frames have been received from the active time master on a cyclical basis. The first cooperative master that detects three missing time message frames in succession assumes the time master function. This ensures that only one time master exists.

Synchronization response

All time slaves and cooperative time masters on the terminal bus synchronize their internal clock with the time message frames received. The time is synchronized as follows:

- Deviation ± 5 s:
  Delay/acceleration of the internal clock

- Deviation > 5 s:
  Immediate conversion (possible errors: Data packets sent off prior to the change will have more recent time stamps than those sent off later)

2.7.2   Time sources for a PCS 7 plant

Overview

In PCS 7 plants, it is necessary to define which component is capable of providing the plant with a satisfactory time in terms of quality. You can use either internal or external time sources for this purpose.

	External time source	Internal time source
Suitability	External time sources provide an ultra-precise time and are suitable for all plant configurations.	Internal time sources supply a continuous time signal. The time provided does not have to match the local time or Coordinated Universal Time (UTC). **Note:** Internal time sources are generally not approved for the validation of processes.
Examples	• GPS decoder • DCF 77 receiver • External NTP server	BIOS clock for a component without external time synchronization.

Internal time source for a PCS 7 plant

Using an internal time source ensures system-wide time consistency. This time does not have to agree with real UTC or with real local time. The following table shows which internal time source can be used for the time master:

Internal time source	Requirement	Active time master
BIOS clock of a central plant clock	The central plant clock is connected to a PCS 7 plant network.	Central plant clock
BIOS clock of a domain controller	The computer to be synchronized belongs to a Windows 2000/2003 domain.	Domain controller
BIOS clock of an OS server	The real time is not important for the project.	OS server

External time source for a PCS 7 plant

Using an external time source ensures system-wide time consistency. This time matches UTC or local time. The following table shows which external time source can be used for the time master:

External time source	Requirement	Active time master of the PCS 7 plant
DCF 77 or GPS signal	Radio signal synchronizes SICLOCK	Central plant clock
DCF 77 signal	The DCF 77 receiver is connected to a COM interface of an OS server.	OS server with DCF 77 receiver
GPS signal	The GPS decoder is connected to a COM interface of an OS server.	OS server with GPS decoder
NTP server	Internet connection	Domain controller

2.7.3 Example of the time synchronization sequence

Introduction

The example below shows an example of time synchronization in PCS 7, based on configurations for an OS.

Note

The individual components are identified in the figures below as follows:

- **Dashed line starting at a component**
  Components with red dashed lines leading away from them are time masters in this network.

- **Arrow pointing to a component**
  Components to which an arrow is pointing are time slaves in this network.

- **(M) at a component next to a bus system**
  An (M) at a component next to a bus system signifies that this component is a cooperative time master for this bus system.

Time synchronization of an OS server

In the image below, the SICLOCK is the time master for the plant. The SICLOCK provides the time for the OS servers and automation systems.

The OS server and the automation systems are configured as time slaves of the SICLOCK. The OS server must be the time master on the terminal bus. The OS clients are time slaves on the terminal bus.

The OS server is the cooperative time master on the plant bus. The OS server assumes the time master function if the connection to the SICLOCK fails.
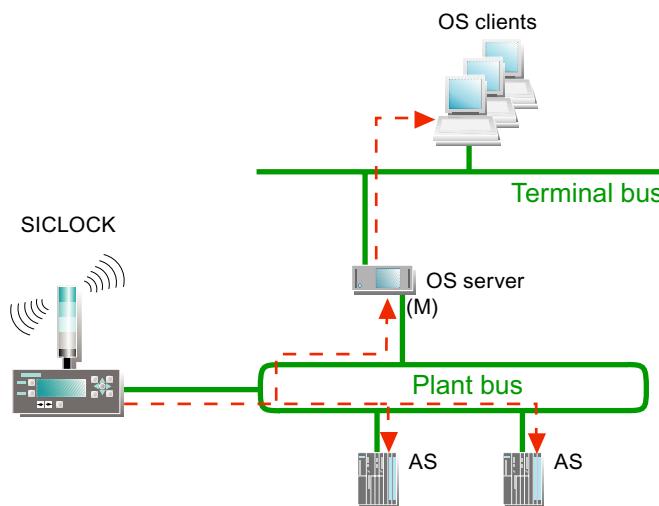
Time synchronization with central plant clock and cooperative time master

In the image below, the SICLOCK is the time master for the plant.

The OS server pair (of redundant OS servers) and the automation systems are configured as time slaves of the SICLOCK.

The OS server pair is the cooperative time master on the plant bus. One of the OS servers assumes the time master function if the connection to the SICLOCK fails.

The OS server pair is configured as the time master on the terminal bus. The OS clients are time slaves on the terminal bus.
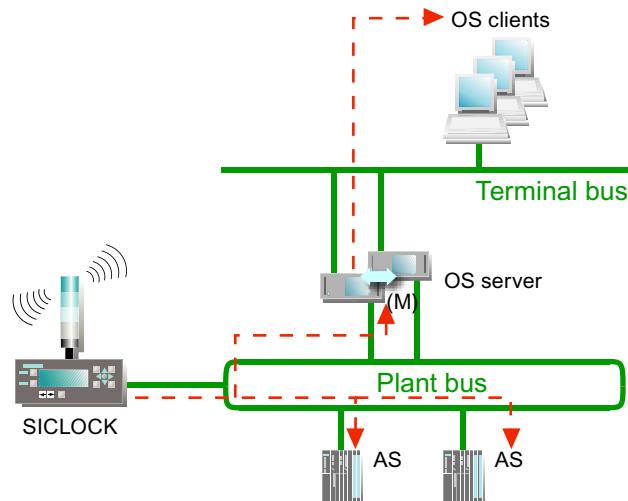
2.8 Network environment of a PCS 7 plant

2.8.1 Overview

Network configuration for time synchronization in PCS 7

The sections that follow provide examples of network configurations for time synchronization in PCS 7.

- Network environment within a domain (Page 27)
- Network environment within a work group (Page 28)
- Network environment in redundant, high-availability networks (Page 29)
- Network environment on separate networks with one central plant clock (Page 31)

2.8.2 Legend for figures used in this documentation

Legend for configuration figures used in this documentation

Note

The individual components are identified in the figures below as follows:

- **Dashed line starting at a component**
  Components with red dashed lines leading away from them are time masters in this network.

- **Arrow pointing to a component**
  Components to which an arrow is pointing are time slaves in this network. (Exception: (M) on a component)

- **(M) at a component next to a bus system**
  An (M) at a component next to a bus system signifies that this component is a cooperative time master for this bus system.
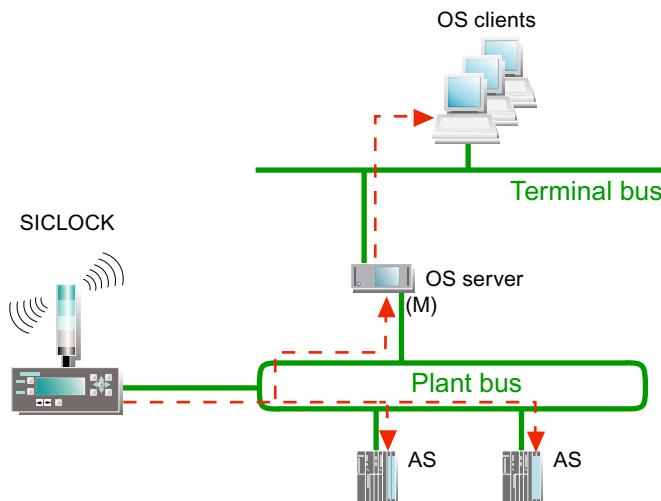
2.8.3   Network environment within a domain

Central plant clock

The SICLOCK TC 400 is particularly suitable for operation as a central plant clock within a domain, as the SICLOCK has four independent Ethernet interfaces.

Structure

The following figure illustrates the recommended configuration for a PCS 7 plant in a Windows domain with a central time clock:
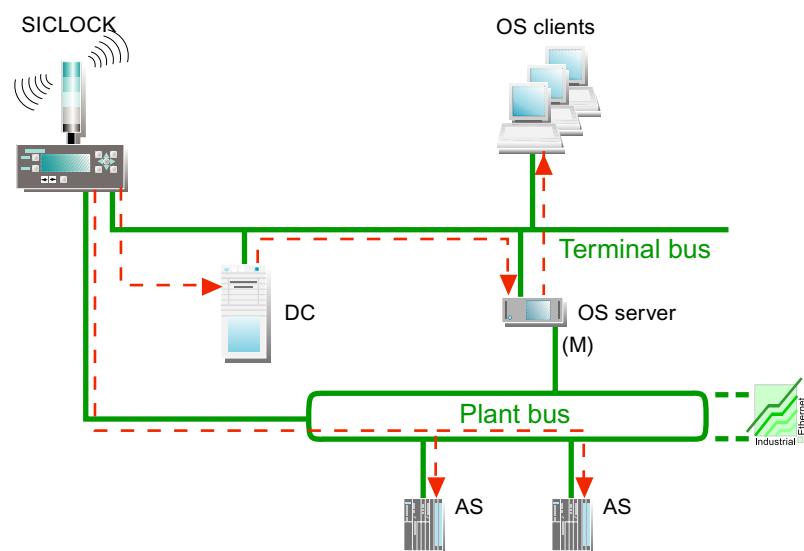
Time synchronization in a domain

The time is synchronized within a domain as follows:

● Time synchronization via plant bus

The plant bus is synchronized using the SICLOCK TC 400.

The synchronization mode depends on the CPU type used (with/without integrated Ethernet interface).

● Time synchronization via terminal bus
The domain controllers are synchronized directly by the central plant clock using NTP mode.
The domain controllers synchronize all domain members using the NTP method.

2.8.4 Network environment within a work group

Central plant clock

The SICLOCK TC 400 is suitable for operation as a central plant clock.

Structure

The following figure illustrates the recommended configuration for a PCS 7 plant in a work group with a central time clock:
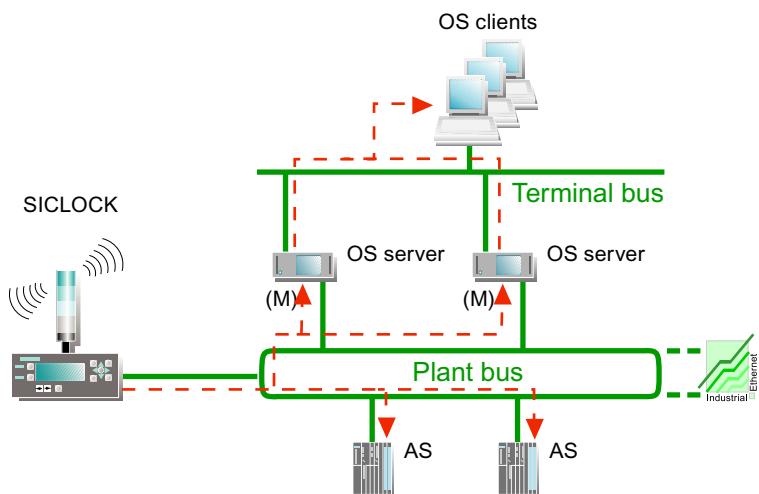
Time synchronization in a work group

The time is synchronized within a work group as follows:

- Time synchronization via plant bus

  The plant bus is synchronized using the SICLOCK.

  The OS servers and the automation systems receive the time from the central plant clock. These are time slaves.

- Time synchronization via terminal bus

  The OS clients receive their time from an OS server. OS clients only receive the time from those OS servers from which they also loaded the server data.

2.8.5 Network environment in redundant, high-availability networks

Introduction

Always install redundant networks in a PCS 7 plant as a precaution against production losses caused by failures in the network connections. This will ensure that communication via the redundant network will remain intact if an area of the terminal bus fails. The domain controllers synchronize one another's time on the basis of Windows mechanisms.

Central plant clock

The SICLOCK TC 400 is suitable for operation as a central plant clock. The SICLOCK can distribute the time signal directly to the plant networks.

Structure

The figure below illustrates the recommended configuration for a PCS 7 plant with a redundant network structure (redundant terminal bus and plant bus):
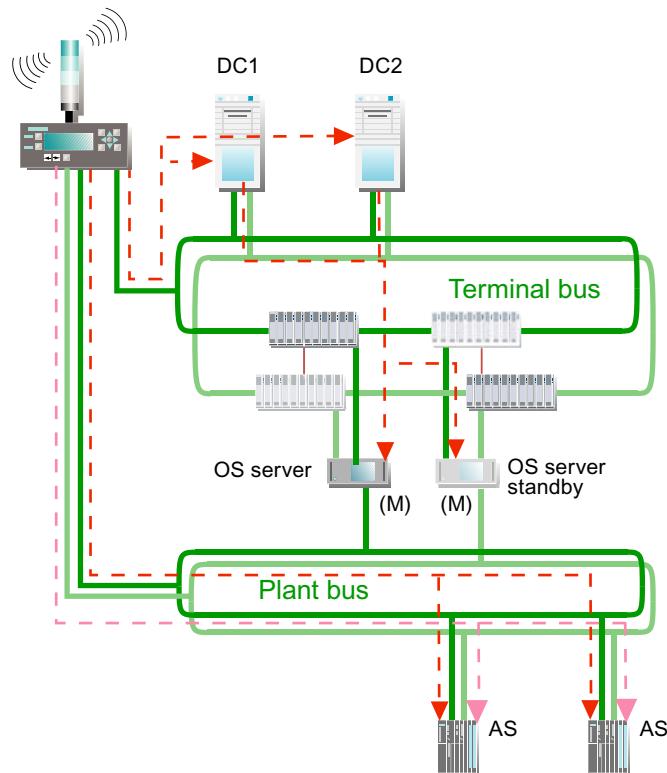
Time synchronization in redundant, high-availability networks

The time is synchronized as follows:

- SICLOCK supplies the exact time.

- The domain controller, terminal bus, and plant bus are synchronized by means of the SICLOCK.

- The domain controllers act as time masters.

- The OS servers actively fetch the time from the domain controller.

2.8.6   Network environment on separate networks with one central plant clock

Central plant clock

If you need to synchronize more than four networks using a single central plant clock (e.g. SICLOCK TC 400) as the time source, you can use suitable switches to provide the time within the individual networks. The switch is only used to distribute time message frames. The remaining plant structure is identical to the relevant plant configuration.

Structure

The following figure illustrates the recommended configuration for a PCS 7 plant on separate networks using a single SICLOCK as the central plant clock:
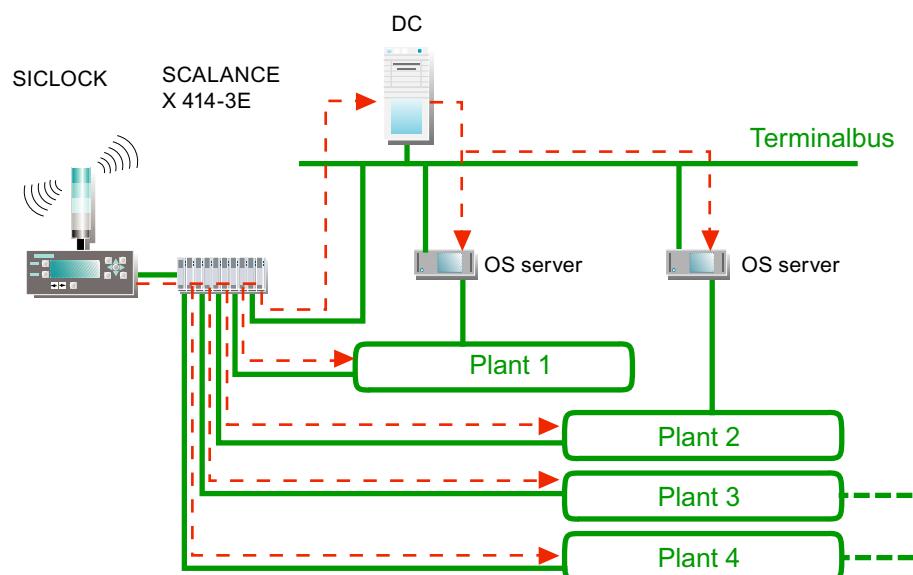
Time synchronization on separate networks with one central plant clock

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Note

You must ensure that each network only contains one time master for providing the time. Separate message frame traffic between the networks.

Only use the switch to transfer the time signals from the central plant clock to the relevant network.

The function for separating message frame traffic is dependent on the components used for connecting the networks.

- Use of suitable SCALANCE switches (e.g. SCALANCE X414-3E)
  Function: Access control

- Use of an OSM/ESM
  Function: Port lock

Bidirectional communication is disabled if the corresponding function is activated.

Additional information

- (http://www.siemens-edm.de/fileadmin/Application_Notes/App_Note_0002.pdf)

- Configuration Manual *Industrial Communication; Industrial Ethernet Switches; SCALANCE X-300; SCALANCE X-400*

- User Manual *SIMATIC NET; Industrial Ethernet OSM/ESM; Industrial Ethernet OSM/ESM*

Configurations for time synchronization of a PCS 7 plant 3

3.1 Overview of recommended configurations

Introduction

Various techniques are possible for time synchronization. The structure of a PCS 7 plant with time synchronization requires careful planning in order to prevent any undesired results. Use one of the following configurations to support you in planning your PCS 7 plant.

Recommended configurations

Plant type	Recommendation	Configuration
Time synchronization in a work group	1	Time synchronization with a central time master (Page 36)
	2	Time synchronization without a central time master (Page 38)
Time synchronization in a Windows domain	3	Time synchronization with a central time master (Page 40)
	4	Time synchronization without a central time master (Page 42)

Configurations in Windows domains

Note

This document subdivides the recommended configurations for time synchronization in a Windows domain (recommendations 3 and 4) on the basis of hierarchy levels. The sections that follow shows the structure in configurations with different hierarchy levels:

- "Configuration of time synchronization with a central time master in a Windows domain with one hierarchy level"
- "Configuration of time synchronization without a central time master in a Windows domain with multiple hierarchies (Page 44)"

3.2 Rules for time synchronization in PCS 7

Rules

- A network may only contain one active time master.

- Time synchronization with an external time source (e.g. GPS, DDF 77) is required if the time within the PCS 7 plant is to match the local time.

- Central plant clocks (synchronized with an external time source wherever possible) are high-grade internal time sources for PCS 7 plants.

- A time slave can be the time master for lower-level components and systems.

- Any domain controllers that are available in a network will synchronize all of the nodes in this network. A synchronization cycle using domain controllers has a duration of eight hours as standard. For reasons of precision, additional synchronization corrections using integrated PCS 7 tools (WinCC time synchronization) are required. You can define an interval at which the OS synchronizes its time with that of an external time source.

- The WinCC "time synchronization" application can be used to configure an OS server as a time master, a cooperative time master, and a time slave.

- An OS server can be configured as a time master either with or without external time synchronization.

- A direct time synchronization of the plant bus is necessary if the "high-precision time stamping" function is used for selected signals in an automation system. The accuracy for high-precision time stamping is insufficient if the central plant clock fails. The chronological order of the signals displayed remains intact.

Time synchronization using NTP mode

The following components are synchronized using NTP mode:

- PC stations that are not operated as OS client or OS servers

- CPU types with integrated Ethernet interface: Please note the following restrictions:

    – Maximum of 50 NTP requests/s

    – When connecting to the OSM (6GK1105-0AA00 and 6GK1105-1AA00), please check whether you have SIMATIC NET - Current edition 2000/025 (incompatibility with tagged frames in Industrial Ethernet OSM networks) (http://support.automation.siemens.com/WW/view/en/4247019).

    – These CPU types may not be used in PCS 7 configurations with only a plant bus (without a terminal bus).

Criteria for time synchronization in existing PCS 7 plants

Compare the configuration of your existing PCS 7 plant with the configurations outlined in this documentation, and configure the time synchronization according to the present configuration.

V5-compatible mode

> **Note**
>
> Contact Customer Support if you want to use time synchronization in V5-compatible mode.

Further information

- Section "Time synchronization in distributed PCS 7 plants (Page 13)"
- Documentation *Process Control System PCS 7; Released modules*

3.3 Configurations for time synchronization in a work group

3.3.1 Configuration of time synchronization with central time master in a work group

Configuration

The following figure is a schematic representation of how time synchronization of a work group with central time master should ideally be configured.
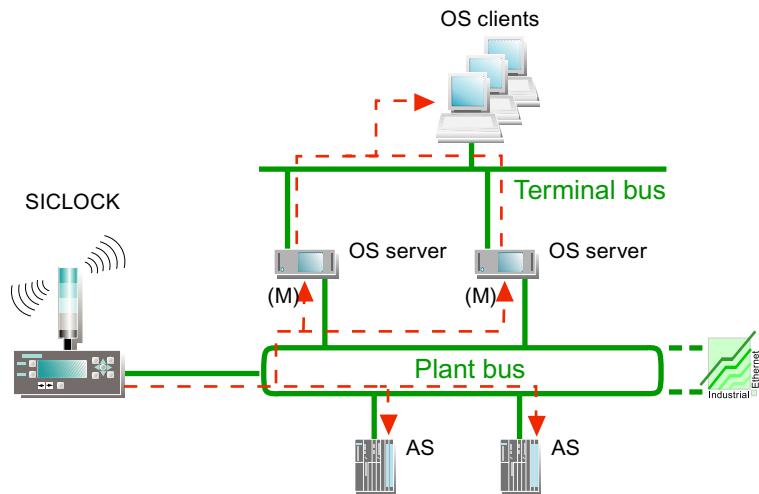
Time master

Central plant clock (SICLOCK TC 400, SICLOCK TM or SICLOCK TS) on the plant bus

Central plant clock

The central plant clock is either synchronized with an external signal (e.g. GPS), or operates with the internal realtime clock.

Time synchronization on the plant bus

- Time master is the SICLOCK connected to the plant bus as the central plant clock. It sends a high-precision broadcast time signal on the plant bus. Time synchronization is set in SIMATIC mode.

- The OS servers are configured as what are known as cooperative time masters. If the SICLOCK no longer sends a time signal, then an OS server becomes active time master and then sends time signals itself on the plant bus, as a replacement.

- Configuring the automation systems:
  - The automation system with standard CPU (without integrated Ethernet interface) is configured for operation as a time slave.
  - The automation system with integrated Ethernet interface is configured for operation as a time master.

- The SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX are configured (see the table below). Time synchronization is set in NTP mode.

Time synchronization on the terminal bus

- During the runtime of a PCS 7 project, an OS server adopts the time signal received from the plant bus. This OS server sets the system time of the other OS servers. You make the settings in the WinCC "Time Synchronization" editor.

- The OS clients are configured as time slaves and receive their time signal from an OS server, from where server data is downloaded.

- PC stations without WinCC time synchronization, such as a BATCH PC or engineering station, are synchronized using a DCF 77 reception service, which must be installed separately. An OS server can be operated as a time master.

Further information

- Section "Configuration steps for time synchronization with central time master in a work group (Page 56)"

3.3.2   Configuration of time synchronization without central time master in a work group

Configuration

The following figure schematically shows the recommended configuration of a PCS 7 plant with time synchronization in a work group without central time master:

Time master

The OS servers are the time masters for the PCS 7 plant.

Time synchronization on the terminal bus

The OS servers are configured for operation as time masters on the terminal bus. One OS server transmits the time message frame to the plant bus. The OS clients are configured for operation as time slaves. They fetch the time from the OS server.

Time synchronization on the plant bus

Configuring the automation systems:

- The automation system with standard CPU (without integrated Ethernet interface) is configured for operation as a time slave.

- The SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX are configured.

NOTICE
Automation system with integrated Ethernet interface
The use of these CPU types in this PCS 7 configuration and in configurations with a combined plant and terminal bus is not permitted. These CPU types can only be synchronized via NTP mode. We recommend using a central plant clock.

Further information

- Section "Configuration steps for time synchronization without a central time master in a work group (Page 57)"

3.4 Configuration for time synchronization in a Windows domain

3.4.1 Configuration of time synchronization with central time master in a Windows domain with a hierarchy

Introduction

In a Windows domain, you should synchronize the terminal bus and the plant bus directly using the central plant clock.

The SICLOCK TC 400 is recommended as the central plant clock as it has four independent Ethernet interfaces.

Configuration

The following figure illustrates the recommended configuration for a PCS 7 plant in a Windows domain with a central time master:
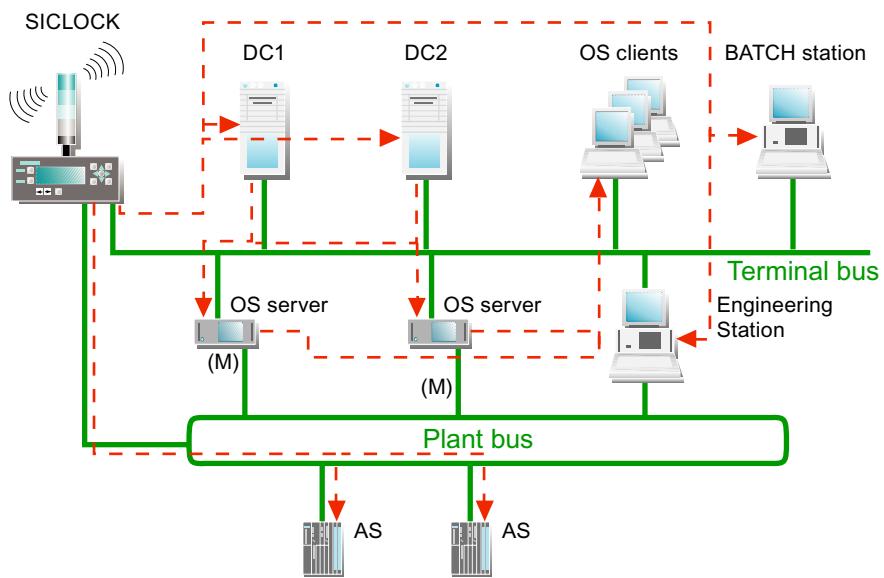
Time master

The SICLOCK central plant clock on the plant bus and the terminal bus

Central plant clock

The central plant clock is either synchronized with an external signal (e.g. GPS), or operates with the internal realtime clock.

Time synchronization on the terminal bus

- Active time master:
  The time master is the domain controller (DC), which is parameterized as the main structure master and/or the PDC emulator (usually the first domain controller installed).

- Time source:
  The domain controller receives the time from the SICLOCK central plant clock. The SICLOCK TC 400 is connected to the terminal bus by means of an Ethernet connection. The SICLOCK TC 400 central plant clock synchronizes the domain controllers by means of the NTP method.

- All other plant PCs automatically become time slaves of the domain controller (PDC emulator) due to their membership in the Windows domain.

- The Windows time service (w32tm) synchronizes the date and time of all computers in a Windows domain. Since the Windows-internal time synchronization only takes place every eight hours, the OS servers are also configured for operation as time slaves of the domain controller (PDC emulator) using the WinCC time synchronization function. The PDC emulator is an operation master role of a domain controller. The domain controller with this operation master role synchronizes the members of the Windows domain every 8 hours.

- Passive time master:
  If the authenticated domain controller (PDC operation master) fails, another domain controller automatically takes over time synchronization within the network.

- The OS clients are configured as time slaves of the OS servers connected and receive their time signal via the terminal bus.

- PC stations without WinCC time synchronization, such as a BATCH PC or engineering station, are synchronized using a DCF 77 reception service, which must be installed separately. As time master one of the domain controllers or an OS server is possible here.
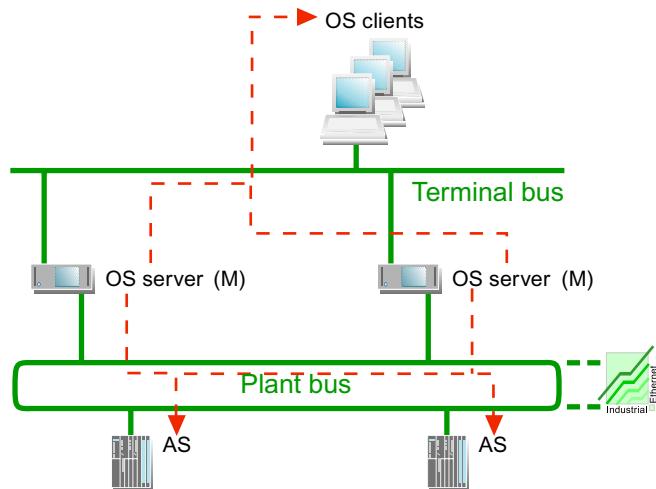
Time synchronization on the plant bus

- The time master for the plant bus is the SICLOCK connected to the plant bus as the central plant clock. It sends a high-precision broadcast time signal to the plant bus (SIMATIC mode).
  The OS servers are configured as what are known as cooperative masters. If the AS no longer sends a time signal then an OS server becomes time master and then sends time signals itself on the plant bus, as a replacement.

- Time synchronization is configured for all automation systems on the plant bus.

Further information

- Section "Configuration steps for time synchronization with a central time master in a Windows domain with a hierarchy (Page 58)"

- For information on configuring authorizing time servers in Windows Server 2003, refer to the relevant Microsoft reference material at the following Internet address: http://support.microsoft.com, subject: Configuring an authorizing time server in Windows Server 2003 (http://support.microsoft.com/kb/816042/en)

3.4.2 Configuration of time synchronization with central time master in a Windows domain with a hierarchy

Configuration

The figure below illustrates the recommended configuration of a PCS 7 plant with time synchronization and without a central time master in a Windows domain.
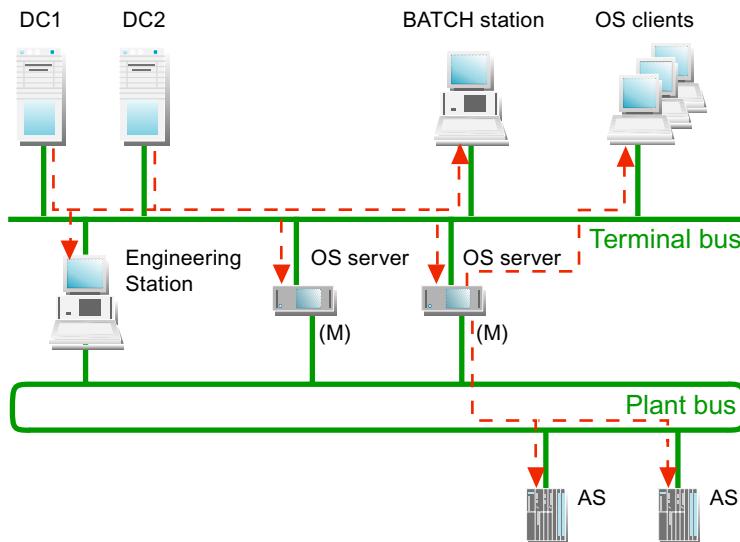
Time master

Domain controller (DC) with PDC emulator operation master role

Time synchronization on the terminal bus

- Time source:
  The domain controller receives the time via an NTP time server, e.g. by means of a radio signal (DCF 77 or GPS module) that contains the precise time.

- Passive time master:
  If the authenticated domain controller (PDC operation master) fails, another domain controller automatically takes over time synchronization within the network.

- Time slaves:
  All other plant PCs are time slaves of the domain controller due to their membership in the Windows domain.

- PC stations without WinCC time synchronization, such as a BATCH station or engineering station, are synchronized using a DCF 77 reception service, which must be installed separately. One of the domain controllers or an OS server can be used as the time master.

Time synchronization on the plant bus

- Synchronization is configured for all automation systems on the plant bus.

- The OS servers receive the time signal via the terminal bus from the authorized domain controller (PDC operation master).

- Each OS server on the plant bus is configured as a cooperative time master. The OS only activates the "time master" function if it does not receive any time signals on the plant bus. OS servers that detect a time signal on the plant bus automatically operate as time slaves.

Further information

- For information about the procedure for configuring the domain controllers as time masters, refer to the relevant Microsoft reference material at the following address: (http://support.microsoft.com/kb/816042/en-us)

- Section "Configuration steps for time synchronization without a central time master in a Windows domain with a hierarchy (Page 59)"

3.4.3 Configuration of the time synchronization in a Windows domain with multiple hierarchies

Configuration

The following figure shows a sample configuration for time synchronization in a Windows domain with multiple hierarchies:
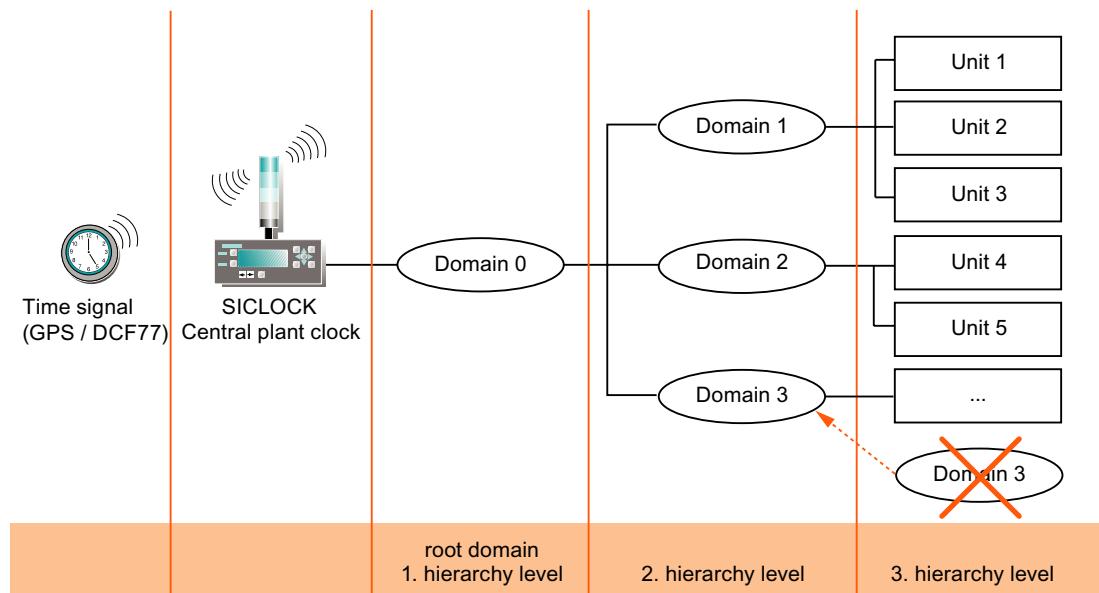
Rules

In order to avoid time jumps, please observe the following rules when setting up the hierarchy for the PCS 7 plants within a Windows domain that contains multiple hierarchies:

- All identical structures must be assigned to the same levels in a Windows domain that contains multiple hierarchy levels. This will prevent unwanted time differences.
  For further information, refer to the section titled "Time levels for a PCS 7 plant (stratum) (Page 17)".

- Create only one hierarchy level under the root domain. Set up any additional Windows domains you may require on the same hierarchy level as the existing subdomains.

Planning time synchronization

4

4.1 Selecting the time master

Selecting the time master

On a time-synchronous PCS 7 plant, you require a time master to which the additional plant components can be synchronized. The table below lists the components that are used as time masters, depending on the network environment:

Time master	With time source ...	Provides the time via ...	Time master forwards the time to...	Forwards the time to ...
SICLOCK	Central clock: Not synchronized, or synchronized (e.g. via GPS or DCF 77)	Terminal bus	Domain controller	-
		Terminal bus	OS server	Terminal bus with OS servers and OS clients
		Plant bus	Automation systems	-
OS server	- BIOS clock - GPS - DCF 77	Terminal bus	OS clients	
		Plant bus	CP of the OS servers that are active time masters	Automation systems
Domain controllers	- GPS - DCF 77 - NTP server	Terminal bus	OS server	OS clients
				Plant bus, including the automation systems
PC	- BIOS clock - GPS - DCF 77 - NTP		All OS servers as time masters	

4.2   Selecting the central plant clock

Introduction

You should always synchronize all automation processes using a standard time. In the case of PCS 7 plants, we recommend performing synchronization by means of a central plant clock. The central plant clock controls the time for the entire PCS 7 plant, and synchronizes all other plant components via their interfaces.

A GPS or DCF 77 signal should be used as the time source for the central plant clock.

Selecting the central plant clock

The following table shows which central plant clocks are offered by the SICLOCK system:

Central plant clock	Ethernet	Inputs	Outputs	GPS decoders	DCF 77 receivers
SICLOCK TC 400	4x RJ45 or ITP	2 x digital	2x digital 24V 1x digital RS422/5V 1 x alarm 1x warning	GPS1000 (GPSDEC)	DCFRS industry version
SICLOCK TM	RJ45 or ITP	2 x digital	8 x digital	GPS1000 (GPSDEC)	DCFRS industry version
SICLOCK TS	RJ45 or ITP	1 x IRIG A+B 1 x digital	1 x IRIG A+B 3 x digital	GPS1000	DCFRS industry version

Representation of the SICLOCK variants

The following figures show a SICLOCK TC 400:

The following figure shows a SICLOCK TM:

The following figure shows a SICLOCK TS:

Further information

- Information concerning central plant clocks on the Internet:
  (http://www.siemens-edm.de/anlagen_zentraluhren.0.html?&L=2)

Configuring time synchronization

<div style="text-align: right">**5**</div>

5.1 Introduction

Components

To synchronize the time of your plant, it is necessary to configure all network nodes for time synchronization. To do this configure the following components depending on configuration:

- Time receivers

    If synchronizing the time using an external time source, you must configure the time recipient for a central plant clock.

- Operator station

    Configure the OS server(s) and the OS clients.

- Communication modules

    Configure the CPs for time synchronization.

- Automation system

    Configure the CPU and the communications processors of the automation system (CP 443-1, CP 443-5 Extended).

- Additional plant components

    The following components should be included in the time synchronization as needed:

    – SIMATIC BATCH

    – SIMATIC Route Control

    – SIMATIC PCS 7 BOX

    – SIMATIC IT

    – Engineering station

Time synchronization modes

The time synchronization mode is activated when configuring time synchronization.

The following options for synchronizing the time of network components are used in PCS 7:

- **Synchronization by means of WinCC time synchronization**
  The "WinCC time synchronization" application is used to synchronize the time of the following components:

  - PC stations on which the software for an OS server or OS client is installed

  - Automation systems in SIMATIC PCS 7 BOX RTX

- **SIMATIC mode**
  SIMATIC mode is used for time synchronization of automation systems on the plant bus (exception: Automation systems with integrated Ethernet interface;
  SIMATIC PCS 7 BOX RTX and SIMATIC PCS 7 AS RTX).

- **NTP mode**
  NTP mode is used for time synchronization of the following components:

  - Domain controller (DC)

  - Automation systems with integrated Ethernet interface
    (order numbers: 6ES7 414-3EM05-0AB0 and 6ES7 416-3ER05-0AB0)

  - PC stations on which the software for an OS server or OS client has not been installed, and which are not synchronized using the DCF 77 reception service.
    Typical application for: SIMATIC BATCH, SIMATIC Route Control, engineering station

- **Synchronization by means of DCF 77 reception service**
  The "DCF 77 reception service" application is used to synchronize the time of the following components:

  - PC stations on which the software for an OS server or OS client has not been installed, and which are not synchronized using NTP mode.
    Typical application for: SIMATIC BATCH, SIMATIC Route Control, engineering station

5.2 Setting the time displayed

5.2.1 How to configure the operator station display

Introduction

You configure the time display for the operator station process mode on the engineering station. You can select the "Local time zone", for example, in the "Time base for time display in runtime" parameter.

Requirement

- You must configure the time display on the engineering station before you load the OS.

Procedure

1. Select the "[Computer name]" object from the tree view in WinCC Explorer.
   The detail view displays the corresponding computer.

2. Select the "[Name of computer]" object in the detail view.

3. Select **Edit > Properties**.
   The "Computer properties" dialog box opens.

4. Select the "Parameters" tab.
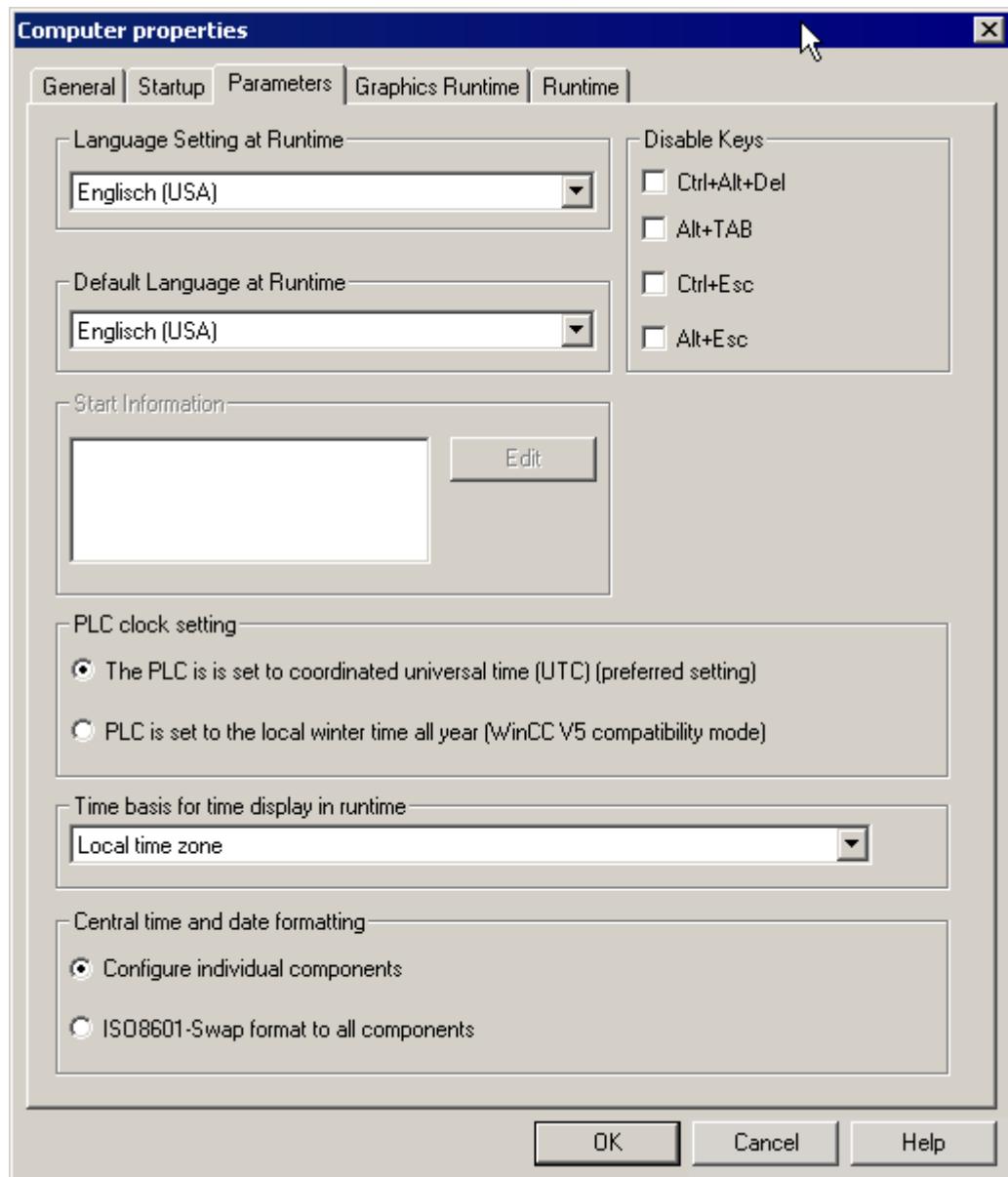
Figure 5-1   Example: Setting for the "Local time zone"

5. Select "The PLC is is set to coordinated universal time (UTC) (preferred setting)" check box in the "PLC clock setting" group.

6. Select the required time mode from the "Time base for time display in runtime" drop-down list box.

   – If you want to set the time for migrated projects: "Time zone of the server (migrated projects)"

   – If you want to set the local time with daylight saving time and standard time: "Local time zone"

   – If you want to set UTC: "Coordinated Universal Time (UTC)"

   The time zone is only important for the display in process mode. Internally, UTC is used exclusively; in archives, for example.

7. Select the required format in the "Central date and time formatting" group. This formatting affects the date and time display within the context of process control.

   – Date in the configured format: "Configure individual components"

   – Date in accordance with ISO 8601: "ISO8601-Swap format to all components"

8. Click "OK".

5.2.2 How to convert the local time zone and daylight saving time parameters

Introduction

You can convert the time displayed on the OS in process mode.

Rules

- If operating a plant across several time zones with different daylight saving time and standard time settings, you should also use the harmonized UTC time for the time display on the operator station. You therefore have a uniform basis for process analysis at all plant units.

- You can configure the switch to daylight saving time or point in time for the switch for each specific country. PCS 7 always handles internal functions on the basis of UTC. Therefore, any conversion to daylight saving time or to a different local time does not have any impact on the internal functions of PCS 7.
  If the time display of the operator station is set to the local time of specific countries, with automatic conversion of daylight saving time and standard time, the time is automatically converted at the correct date and time.

Requirements

- It must be possible to operate the operating system environment.
- You must make the settings directly on the OS.

Procedure

To change the operator station to display daylight saving time and standard time, follow these steps:

1. Go to the Window Start menu on the OS and select **Start > Settings > Control panel**.

2. Double-click the "Date and Time" icon.

3. Select the "Time Zone" tab.
   Ensure that the time zone displayed in your list field is appropriate for your area

4. Select the check box "Automatically adjust clock for daylight saving changes".
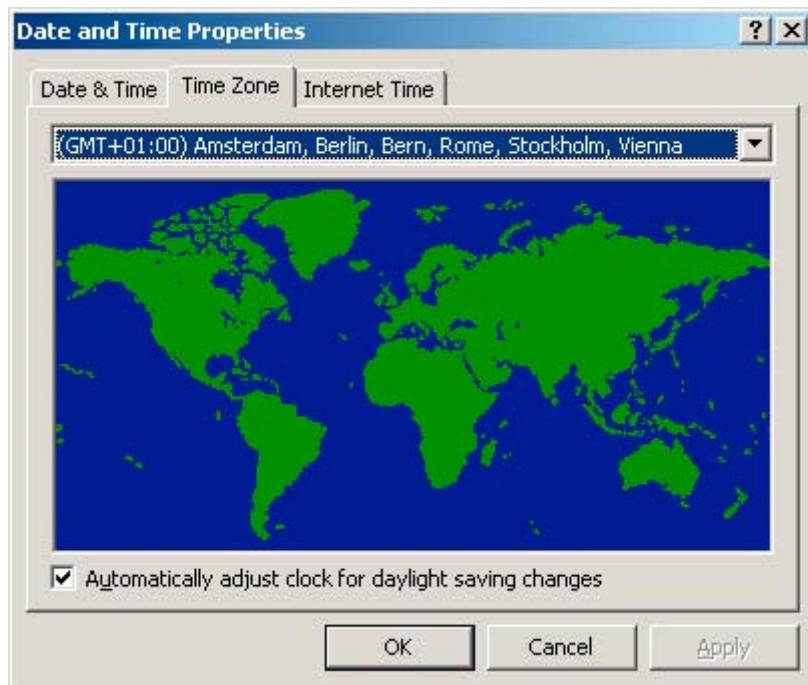
5. Click "OK".

Result
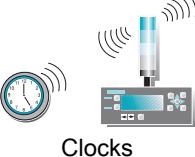
All time information for the operator station will be output in the local time of the selected time zone, including daylight saving time changes, and it will be converted at the correct point in time.

5.3 Overview of configuration steps, depending on the configuration

5.3.1 Configuration steps for time synchronization with central time master in a work group

Overview of configuration steps

The table below shows the configuration steps required for time synchronization with a central time master in a work group, including a reference to the sections of this documentation that provide a description of these steps:

Step	Time synchronization components	Configuration steps	Operating instructions in section:
1	Clocks	Clocks - connection, installation, and parameter assignment (e.g. SICLOCK with GPS or DCF 77)	"Commissioning a central plant clock (Page 60)"
2	AS	Parameterizing automation systems as time slaves	• CPU without integrated Ethernet interface: "How to set time synchronization on an AS for SIMATIC mode (Page 99)" • CPU with integrated Ethernet interface: "How to set time synchronization on an AS for NTP mode (Page 105)" • SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX: "Configuring time synchronization for the SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX (Page 109)"
3	CP	Assigning parameters for CP for the plant bus	
4	OS server	Parameter assignment for an OS server as cooperative master	"How to set time synchronization on an OS in a work group with central time master (Page 72)"
5	OS server	Parameter assignment for redundant OS servers	
6	OS clients	Parameter assignment for OS clients	

5.3.2 Configuration steps for time synchronization without a central time master in a work group

Overview of configuration steps

The table below shows the configuration steps required for time synchronization without a central time master in a work group, including a reference to the sections of this documentation that provide a description of these steps:

Step	Time synchronization components	Configuration steps	Operating instructions in section:
1	AS	Parameterizing all automation systems	• CPU without integrated Ethernet interface: "How to set time synchronization on an AS for SIMATIC mode (Page 99)" • CPU with integrated Ethernet interface: "How to set time synchronization on an AS for NTP mode (Page 105)" • SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX: "Configuring time synchronization for the SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX (Page 109)"
2	OS servers	Parameterizing OS servers as time masters	"How to set time synchronization on an OS in a work group without central master." (Page 75)"
3	OS clients	Parameterizing OS clients	

5.3.3 Configuration steps for time synchronization with a central time master in a Windows domain with a hierarchy

Overview of configuration steps

The table below shows the configuration steps required for time synchronization with a central time master in a Windows domain with a hierarchy, including a reference to the sections of this documentation that provide a description of these steps:

Step	Time synchronization components	Configuration steps	Operating instructions in section:
1	SICLOCK with GPS or DCF 77	Clocks - connection, installation, and parameter assignment	• "Commissioning a central plant clock (Page 60)"
2	DC	Parameterizing domain controllers as time masters	See Microsoft reference material
3	PC, e.g. BATCH station	Parameterizing PCs without WinCC time synchronization via DCF 77	• "How to make DCF 77 Client Service settings on a PC station without OS (Page 93)"
4	OS clients	Parameterizing OS clients	• "How to set time synchronization on an OS in a domain with central time master. (Page 79)"
5	OS servers	Parameterizing OS servers as cooperative time masters	
6	AS	Parameterizing automation systems	• "How to set time synchronization on an AS for SIMATIC mode (Page 99)." • "How to set time synchronization on an AS for NTP mode (Page 105)" • "Configuring time synchronization for the SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX (Page 109)"

5.3.4 Configuration steps for time synchronization without a central time master in a Windows domain with a hierarchy

Overview of configuration steps

The table below shows the configuration steps required for time synchronization without a central time master in a Windows domain with a hierarchy, including a reference to the sections of this documentation that provide a description of these steps:

Step	Components for time synchronization	Configuration steps	Operating instructions in section:
1	DC	Parameterizing domain controllers as time masters	See Microsoft reference material
2	PC	Parameterizing PCs without WinCC time synchronization via DCF 77	• "How to make DCF 77 Client Service settings on a PC station without OS (Page 93)"
3	OS server	Parameterizing OS servers as cooperative time masters	• "How to set time synchronization on an OS in a domain without central time master. (Page 85)"
4	AS	Parameterizing automation systems as time slaves Note: CPU types with an integrated Ethernet interface cannot be used in this plant configuration.	• "Configuring time synchronization on an AS (Page 99)"

5.4 Commissioning a central plant clock

5.4.1 Commissioning the SICLOCK TC 400

Requirement

To configure the SICLOCK TC 400, the Java runtime software is required. Only install the Java runtime software for accessing the SICLOCK TC 400 on an engineering station or a separate PC station (not on components that are involved in process mode).
The Java runtime software is supplied on a CD together with the SICLOCK TC 400.

Overview of configuration steps

The table below shows the configuration steps that are needed to operate the SICLOCK TC 400 as a clock for time synchronization of a PCS 7 plant:

Step	What?
1	Wire the time receiver to the SICLOCK TC 400
2	Parameterize the time receiver
3	Set the basic parameters on the SICLOCK TC 400
4	Connect the SICLOCK TC 400 to the PCS 7 plant
5	Configure the SICLOCK TC 400 on a plant-specific basis via Internet Explorer

By way of example, the following sections list the most important settings for configuration in a PCS 7 plant:

● In the examples below, the central plant clock SICLOCK TC 400 receives a time signal via a GPS radio clock.

● The terminal bus (port: ETH1) and plant bus (port: ETH2) are synchronized directly using the central plant clock SICLOCK TC 400.

Factory settings of the SICLOCK TC 400

The SICLOCK TC 400 is supplied with the following default settings for the Ethernet ports:

● Subnet mask 255.255.255.0

● Port: ETH1: 192.168.1.10

● Port: ETH2: 192.168.2.20

● Port: ETH3: 192.168.3.30

● Port: ETH4: 192.168.4.40

Set the basic parameters on the SICLOCK TC 400

The direct parameter settings on the SICLOCK TC 400 are required as basic parameters for connection to the network only.

1. Press the "Setup" button on the SICLOCK TC 400.

2. Enter the password and then press "OK".
   The parameter list is displayed:

   – Language (select German or English)

   – ETH1 IP address

   – ETH1 IP subnet

   – ETH1 IP gateway

   – ETH2 IP address

   – ETH2 IP subnet

   – ETH2 IP gateway

   – ETH3 IP address

   – ETH3 IP subnet

   – ETH3 IP gateway

   – ETH4 IP address

   – ETH4 IP subnet

   – ETH4 IP gateway

   – Acknowledge events

   – Version (for information only)

3. Perform the settings for the required Ethernet connections.

Configuring the SICLOCK TC 400

1. Connect the SICLOCK TC 400 to the network.
   (For example, connect Ethernet port ETH1 of the SICLOCK TC 400 to the terminal bus)

2. Open Internet Explorer on a PC. Enter the network address of the SICLOCK TC 400 in the input field (e.g. Port:ETH1 = address 192.168.1.10).

3. In the configuration portal area, click the "SICLOCK TC 400 configuration tool" link. The configuration tool opens.

4. Select **Data Transfer > Download parameters from device** from the configuration tool menu.

5. Configure the SICLOCK TC 400 in accordance with the table below.

Note

The identifier "= ..." in the "Parameters and setting" column represents the "plant-specific setting".

Table 5- 1   Settings

Folder	Parameters and setting	Description
Time	Time zone = ... (optional = ...)	"Time zone" parameter, "Offset between UTC and zone time" entry
Network settings	e.g. Port: Ethernet 1 (ETH1) • IP adapter 1 / IP address = ... • IP adapter 1 / subnet mask = ...	Enter the plant-specific network address(es). Configure the network connections ETH2, ETH3 and ETH4 in the same way.
SIMATIC mode	e.g. Port: Ethernet 2 (ETH2) • Mode = PCS 7-compatible mode, every 10 seconds • Send condition = "No condition" • Target address = "FF:FF:FF:FF:FF:FF"	SIMATIC mode is available at all four Ethernet ports. Note: **Only** activate SIMATIC mode for the ETHERNET ports on the plant bus. A synchronization time of 10 seconds is recommended for PCS 7. A broadcast telegram is sent to all nodes on this network.
NTP server	NTP server • Operation = On • Mode = 10 s • Multicast address = ...	The NTP server is available at all four Ethernet ports. Requirements: SICLOCK TC 400 is synchronized. Multicast address: Enter the plant-specific IP address for NTP time synchronization.
Display	Display: • Language = ... • Time / Time base = ...	• Language setting: German or English • Time base: Local time, UTC or atomic time (TAI) Select the time that will appear on the display.

Note

For the purpose of time synchronization on the plant bus, activate SIMATIC mode separately for each Ethernet port.

The settings can be password-protected.
You will find additional information on this topic in the *SICLOCK; SICLOCK TC 400* Operating Instructions.

Loading the configuration to the SIMATIC TC 400

This step is only necessary if the configuration is carried out **offline**.

Select **Data Transfer > Download parameters to device** from the configuration tool menu.

Backing up the configuration

To save the set SICLOCK parameters and event display (archive) to a file, select the following menu command: **File > Save**.

The data (parameter settings and archive) are saved in U600 format.

Connecting the time receiver

To ensure that the central plant clock is in constant receipt of an accurate time, it should be synchronized with a time receiver.The following time receivers are recommended in PCS 7:

- SICLOCK GPS1000
- SICLOCK GPSDEC
- SICLOCK DCFRS Industry version

Additional information

- Section "Rules for time synchronization in PCS 7 (Page 34)"
- Section "Commissioning the DCF 77 receiver (Page 69)"
- Section "Commissioning GPS receivers (Page 66)"
- *SICLOCK; SICLOCK TC 400* Operating Instructions

5.4.2   Commissioning the SICLOCK TM/TS

Overview of commissioning tasks

The table below shows the commissioning tasks that are needed to operate the SICLOCK TM/TS as a central plant clock for time synchronization in a PCS 7 plant:

Step	What?
1	Wire the time receiver to the SICLOCK TM/TS
2	Parameterize the time receiver
3	Assign parameters to the SICLOCK TM/TS (SIMATIC or NTP mode)
4	Connect the SICLOCK TM/TS to the PCS 7 plant

By way of example, the following sections provide the most important settings for the configuration in a PCS 7 plant where the automation systems are synchronized using SIMATIC mode.

Note

Siclock Remote parameterization software

You can use the "Siclock Remote" parameterization software to make the settings for the SICLOCK TM and SICLOCK TS central plant clocks. This software is available on the Internet together with a set of parameter assignment instructions: http://www.siemens-edm.de (http://www.siemens-edm.de/anlagen_zentraluhren.0.html?&L=2).

Assigning parameters to the SICLOCK TM/TS for SIMATIC mode

Make the following settings directly on the SICLOCK TM/TS:

1. Call the parameters of the SICLOCK TM/TS.

2. Set the parameter 338/6A Ethernet to "On."

3. Select an unassigned IP address on your plant bus and configure this at parameter 343/6A of the SICLOCK TM/TS.

4. Make the additional settings according to the following table:

Parameter	Value
341/6A "Source addr. part 0"	<MAC address>
342/6A "Source addr. part 1"	<MAC address>
339/6A	"LAN connection"
350/6B "Addr. 1 protocol"	"Layer 2 - S5"
351/6B "Send addr. 1"	"Each second"
353/6B "Addr. 1 dest. 0"	"FFFFFF"
354/6B "Addr. 1 dest. 1"	"FFFFFF"
338/6A "Ethernet"	"On" or "synchronized"

Assigning parameters to the SICLOCK TM/TS for NTP mode

Make the settings directly on the SICLOCK TM/TS.

1. Call the parameters of the SICLOCK TM/TS.

2. Set parameter 338/6A Ethernet to "On."

3. Select an unassigned IP address on your plant bus and configure this at parameter 343/6A of the SICLOCK TM/TS.

4. Enter "any/unicast" for parameter 550/6F "SNTP-Server".

Note

Check the parameter settings if necessary. Please note the following:

- If you are using a different central plant clock, set the parameters of this clock accordingly.
- Ther SICLOCK TM/TS supports up to 50 NTP requests per second.

Note

To activate the NTP server on SICLOCK TM/TS assign parameters for SICLOCK TM/TS in addition to the normal network operation as follows:

1. In the parameter **343/6A "IP Source Addr."** in the menu 6A assign the device an IP address.

2. Set the parameters **344/6A "Subnet mask"** and possibly **345/6A "Default gateway"** in the menu 6A in accordance with the IP network.

3. In the menu 6F set the parameter 550/6F "SNTP Server" = "any/unicast".

Note

Changing parameters in the network menu of the SICLOCK TM/TS

You can only change the parameters in network menu 6A ...6F if network operation of the device is temporarily disabled.

First set the parameter **338/6A "Ethernet" = off**. After you have set the parameters, switch network operation on again (parameter 338/6A "Ethernet" = on or synchronized).

Connecting the time receiver

To ensure that the central plant clock is in constant receipt of an accurate time, it should be synchronized with a time receiver. The following time receivers are recommended in PCS 7:

- SICLOCK GPS1000
- SICLOCK GPSDEC
- SICLOCK DCFRS Industry version

Additional information

- Section "Rules for time synchronization in PCS 7 (Page 34)"
- The complete configuration settings for the SICLOCK TM/TS are provided in the SICLOCK TM/TS documentation.

5.4.3   Commissioning GPS receivers

Introduction

The GPS receiver determines the UTC via the satellite-based GPS system (Global Positioning system). Due to the country-specific installation of Windows on the OS the sent UTC is converted to the time valid in the respective country. For reception of the precise time reception of the signal from one of the 24 satellites suffices. The GPS receiver also enables worldwide use of SIMATIC PCS 7 with inter-plant time synchronization.

Overview of commissioning tasks

The table below shows the commissioning tasks that are needed to connect a GPS receiver to a central plant clock for the purpose of time synchronization within the context of a PCS 7 plant:

Step	What?
1	First commissioning of the GPS receiver Configure the GPS receiver with the aid of the associated commissioning software.
2	Connect the GPS receiver cable
3	Align the GPS antenna

"DCF 77 reception service" software

The "DCF 77 reception service" software is supplied together with the SICLOCK TM/TS. You will need the "DCF 77 reception service" software in the following scenarios:

● When connecting the SICLOCK TM/TS to a domain controller
If you are using the SICLOCK TC 400, the DCF 77 reception service will not be required.

● When connecting a DCF 77 receiver directly to a PC station
You will find additional information on this topic in Section "Configuring directly connected time receivers (Page 96)".

Wiring

- The following figure shows how the GPS receiver is connected to the SICLOCK TC 400:
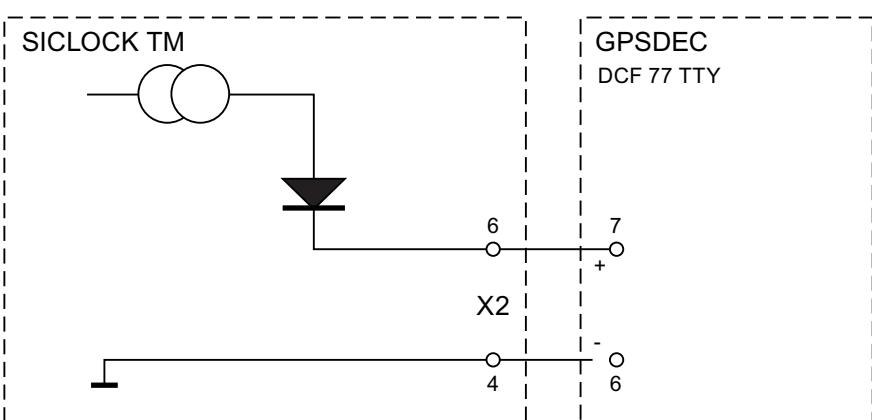
SICLOCK GPS 1000

SICLOCK TC 400

X2

	6
RADIO CLOCK GND	7
RADIO CLOCK 1A	8
RADIO CLOCK 1B	9
RADIO CLOCK 2A	10
RADIO CLOCK 2B	11

Max. 1,000 m

CAUTION

The GPS receiver may only be used as an active radio clock. The GPS receiver will be destroyed if operated as a passive radio clock.

- The following figure shows how the GPS receiver is connected to the SICLOCK TM:

SICLOCK TM

GPSDEC
DCF 77 TTY

6   7
+

X2

-
4   6

Aligning the GPS antenna

Proceed as follows:

1. Install the GPS antenna.

2. Align the antenna vertically to the sky.

   With other angles the synchronization can fail temporarily because a satellite is not in the reception window.

   ### Note

   Do not install the GPS antenna at locations where there is a risk of lightning strikes occurring.
   If nothing else is possible, attach the GPS antenna to the inside of high windows.

Further information

- Additional information on the connection and optimal alignment of the GPS receiver can be found in the Operating Instructions for the GPS receiver.

- Additional information on connecting a central plant clock can be found in the Operating Instructions for the central plant clock.

5.4.4   Commissioning the DCF 77 receiver

Introduction

DCF 77 is an officially approved standard time in Germany.

The DFC 77 radio signal is limited to a radius of 800 km around the Frankfurt/Main area. In regions where the DCF 77 radio signal cannot be received, use of a GPS receiver is recommended. You need a DCF 77 receiver to use this radio signal for time synchronization of your PCS 7 plant.

Structure of the DCF 77 receiver

The following components are included in the scope of delivery of a DCF 77 receiver:

● An antenna head with or without an antenna frame.
  The DCF 77 receiver is located in the antenna head and demodulates the DCF 77 signal.

● Software for installation on the target system to be synchronized
  If the DCF 77 receiver is being connected directly to the central plant clock, there is no need for any additional driver software.

Overview of commissioning tasks

The table below shows the commissioning tasks that are needed to connect a DCF 77 receiver to a central plant clock for the purpose of time synchronization within the context of a PCS 7 plant:

| Step	What?
1	First commissioning of the DCF 77 receiver
	Configure the DCF 77 receiver with the aid of the associated commissioning software.
2	Connect the DCF 77 receiver cable
3	Align the antenna

"DCF 77 reception service" software

The "DCF 77 reception service" software is supplied together with the SICLOCK TM/TS. You will need the "DCF 77 reception service" software in the following scenarios:

● When connecting the SICLOCK TM/TS to a domain controller
  If you are using the SICLOCK TC 400, the DCF 77 reception service will not be required.

● When connecting a DCF 77 receiver directly to a PC station
  You will find additional information on this topic in Section "Configuring directly connected time receivers (Page 96)".

Wiring

The following figure shows how to wire the SICLOCK TC 400 to a DCF 77 receiver:
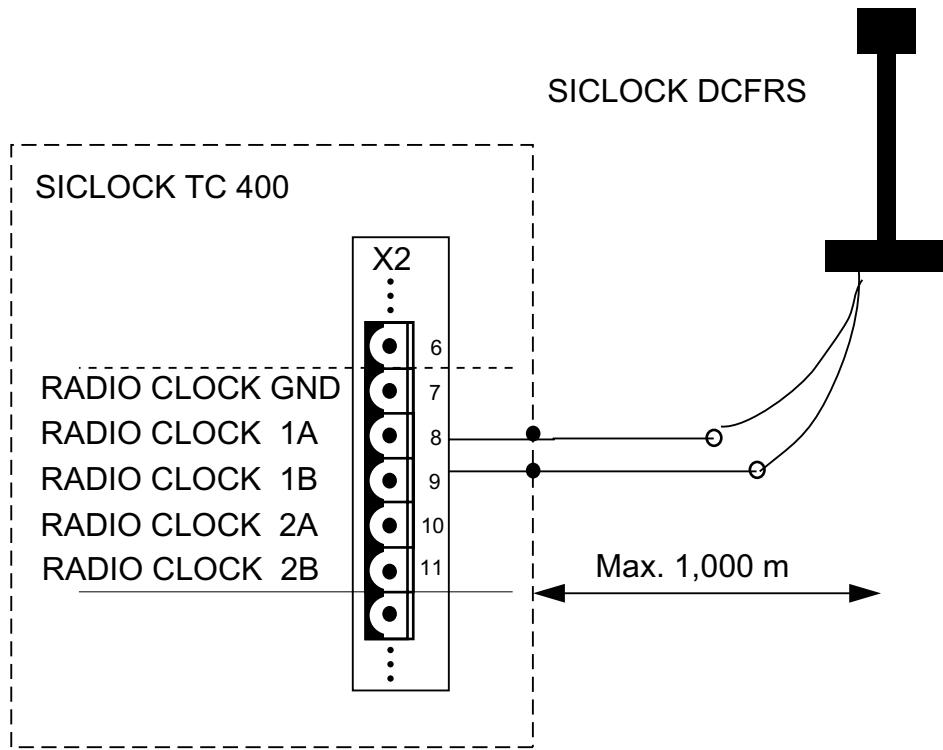
Align the antenna

To optimize the alignment of your DCF 77 receiver, proceed as follows:

1. Align the DCF 77 receiver so that the control LED flashes at intervals of one second.

2. Check that the DCF 77 receiver is on the side of your building facing Frankfurt.

> **Note**
>
> If you are unable to receive a constant time signal, please note the following rules:
>
> - Maintain as great a distance as possible between the DCF 77 receiver and PCs, monitors, laser printers, motors, motorized operating mechanisms, or similar sources of interference.
> - Keep the DCF 77 receiver away from metal surfaces and steel-reinforced concrete.

Further information

- Additional information on the connection and optimal alignment of the DCF 77 receiver can be found in the Operating Instructions for the DCF 77 receiver.

- Additional information on connecting a central plant clock can be found in the Operating Instructions for the central plant clock.

5.5 Configuring the time synchronization of the OS

5.5.1 Overview of configuration steps

Overview of configuration steps

The following table shows the configuration steps that are necessary for configuring the time synchronization on the operator station:

Step	OS components	What?
1	CP	Parameterize the communication modules (CP 1623, CP 1613, CP 1612, BCE/Softnet) on the plant bus
2	OS server	Configure time synchronization for the OS servers that are active time masters
3	OS clients	Configure time synchronization for the OS clients that are time slaves

5.5.2 How to set time synchronization on an OS in a work group with central time master
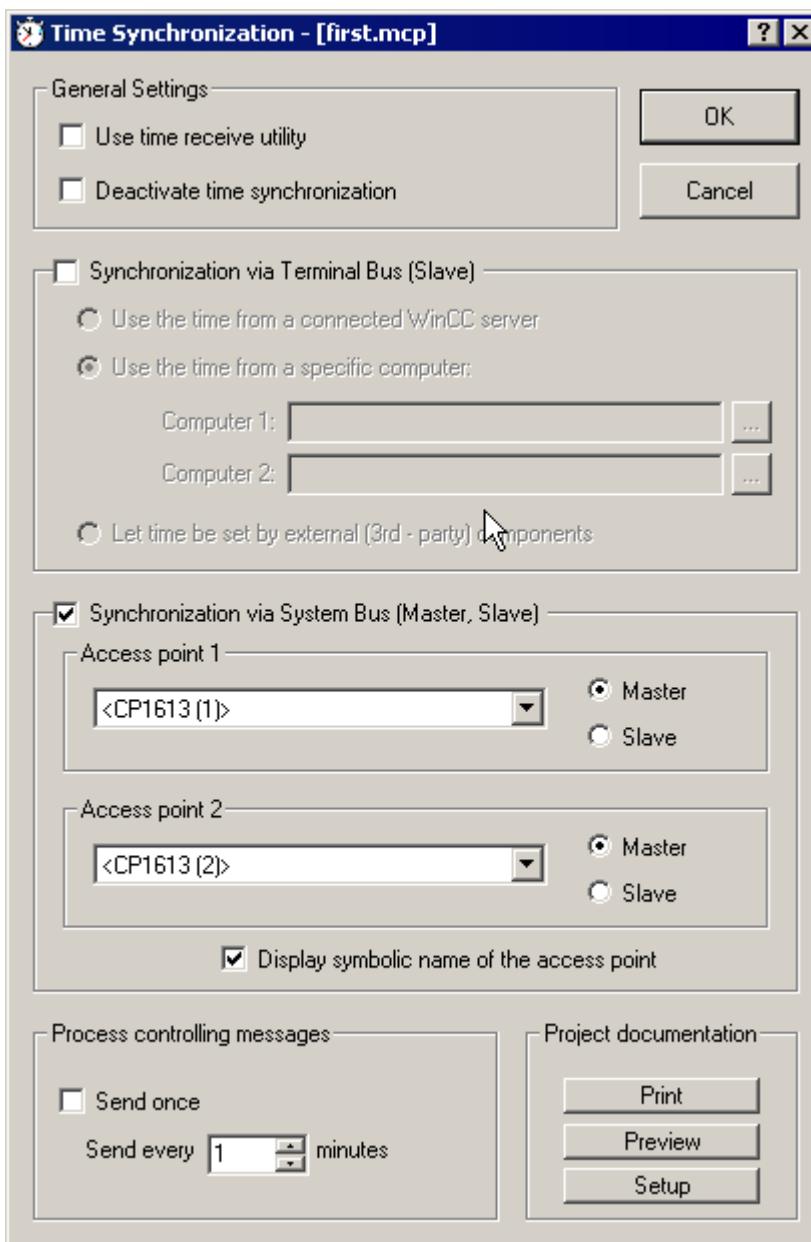
Example configuration
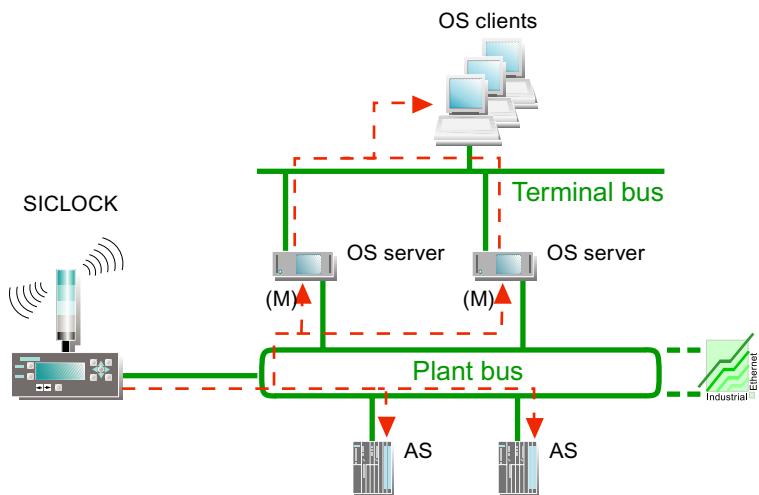
Requirements

- The "Time tracking" option must be activated in the configuration console for the network adapter of the OS server.

- All automation systems must be configured as time slaves (exception: CPU 416-3 PN/DP and CPU 414-3 PN/DP).

- The following network adapters can be used for the OS servers:
  - CP 1613 or CP 1623 (more than 8 AS or high-availability AS)
  - BCE (up to 8 AS)

Configuring the OS server for time synchronization

To configure the OS server for time synchronization, proceed as follows:

1. Open the OS server in the PCS 7 project on the engineering station.

2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.

4. Select the "Synchronization via plant bus (master, slave)" check box.

5. From the "Access point 1" drop-down list box, select the network adapter for which you have activated time synchronization in the configuration console. The list shows all devices installed on the computer that are suitable for time synchronization.

6. Select the "Master" option button.

7. If using a redundant network adapter, select the required network adapter from the "Access point 2" drop-down list box.

8. Select the "Master" option button.

9. Click "OK".

Configuring the OS client for time synchronization

To configure time synchronization for OS clients, proceed as follows for each OS client:

1. Open the OS client in the PCS 7 project on the engineering station.

2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

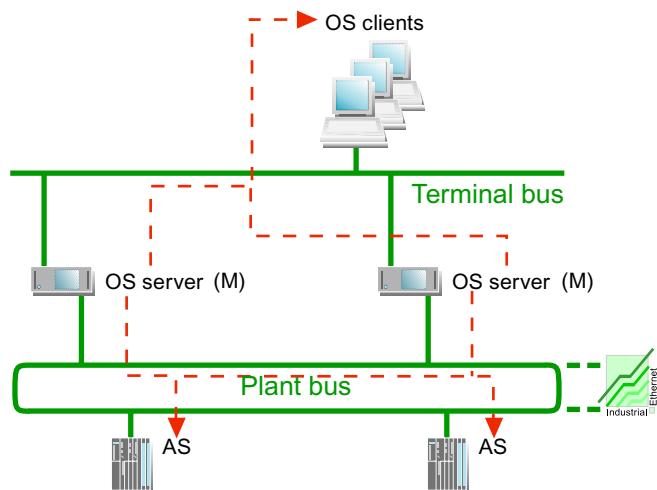3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
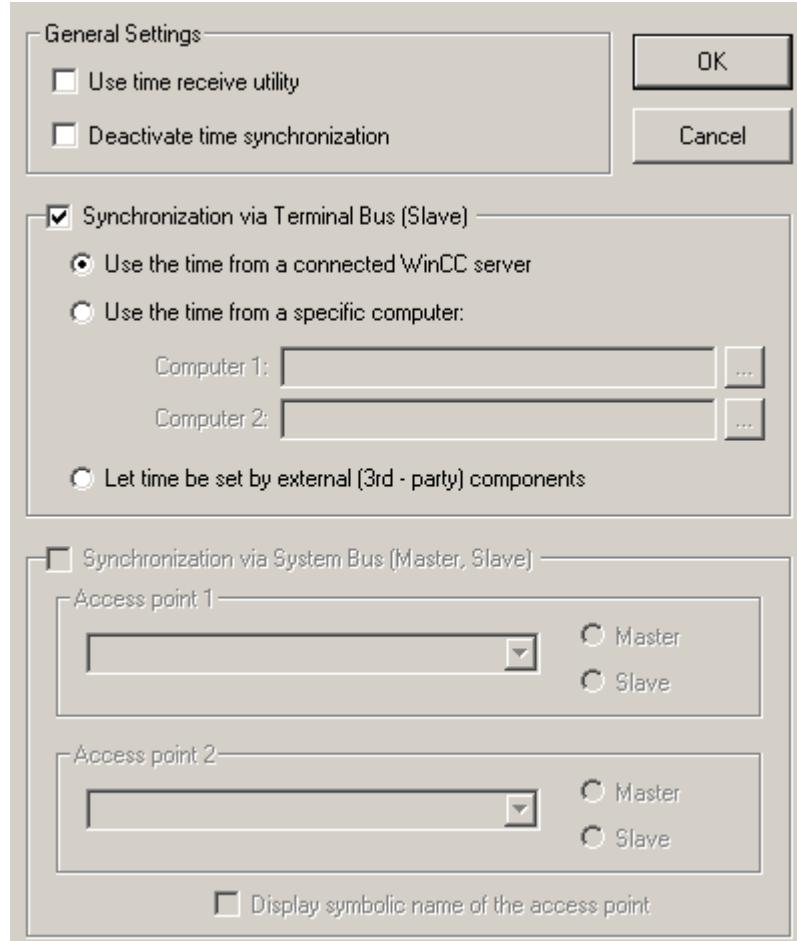
4. Select the check box "Synchronization via Terminal Bus (slave)".
   All associated options buttons and text boxes can be selected.

5. Select the option button "Accept time from a connected WinCC server".

6. Click "OK".

5.5.3 How to set time synchronization on an OS in a work group without central master

Example configuration

Requirements

- The OS server must be the time master on the plant bus
- All automation systems must be configured as time slaves.
- Restriction: CPU 416-3- PN/DP and CPU 414-3 PN/DP cannot be used in this configuration (synchronization lacking).
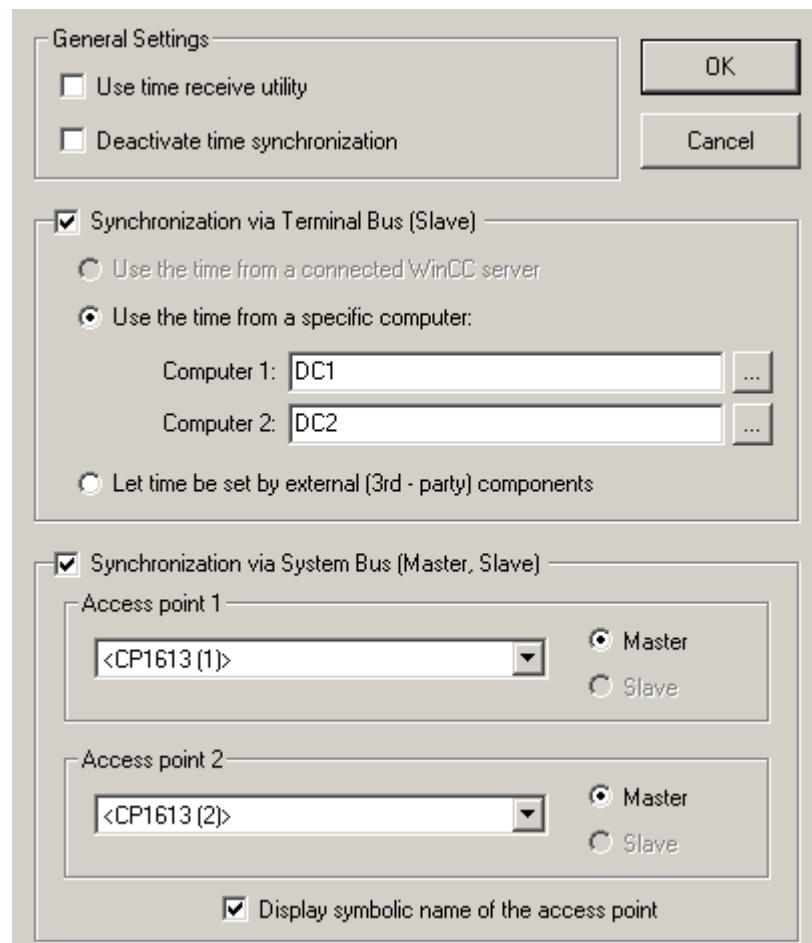
Setting the terminal bus

To configure the OS server for time synchronization, proceed as follows:

1. Open the OS server in the PCS 7 project on the engineering station.

2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.

4. Select the "Synchronization via terminal bus (slave)" check box.

5. Select the "Accept time from permanently defined computers" check box and enter the name of the computer with the DCF/GPS receiver under "Computer 1".

6. Select the "Synchronization via plant bus (master, slave)" check box.

7. Select the option button "Display symbolic names of the access points".

8. Select the communications processor ("CP 1613" or "CP 1623") from the "Access point 1" drop-down list box and activate the "Master" option button.

9. Select "<None>" from the "Access point 2" drop-down list box.

10. Click "OK".

Result

The communication module can send and receive the time message frames. The OS servers are cooperative time masters. If a communications processor (CP1613, CP 1623) does not receive a time signal on the plant bus, WinCC time synchronization automatically switches to master mode. It will then send substitute time signals for the failed time master.

⚠ **CAUTION**

If a time jump of more than 5 seconds occurs, the computer defined as the time master becomes a time slave. The message "Time synchronization has been permanently switched to slave" is generated.

Note that also after a restart this computer is no longer defined as time master. Reconfigure the computer as time master and load the configuration on the computer.

Configuring the OS client for time synchronization

To configure OS clients for time synchronization, proceed as follows for each OS client:

1. Open the OS client in the PCS 7 project on the engineering station.

2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
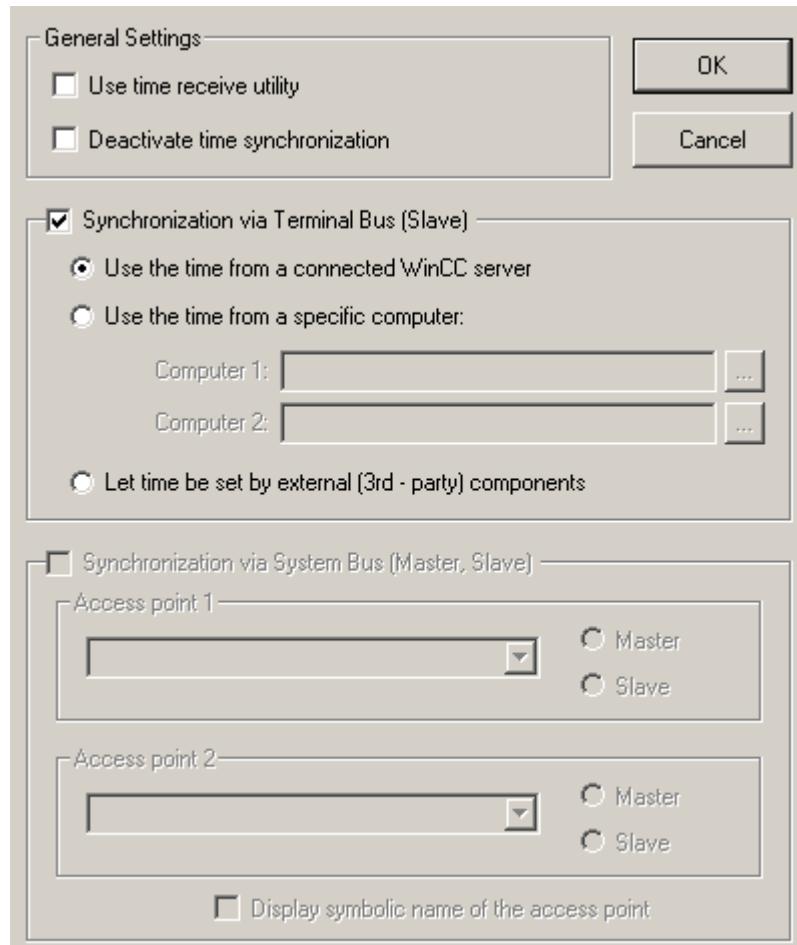
4. Select the "Synchronization via terminal bus (slave)" check box.
   All associated check boxes and text boxes will then be made available for selection.

5. Select the "Accept time from a connected WinCC server" option button.

6. Click "OK".

5.5.4 How to set time synchronization on an OS in a domain with central time master

Example configuration

The SICLOCK TC 400 central plant clock is used in a Windows domain for time synchronize of the OS.
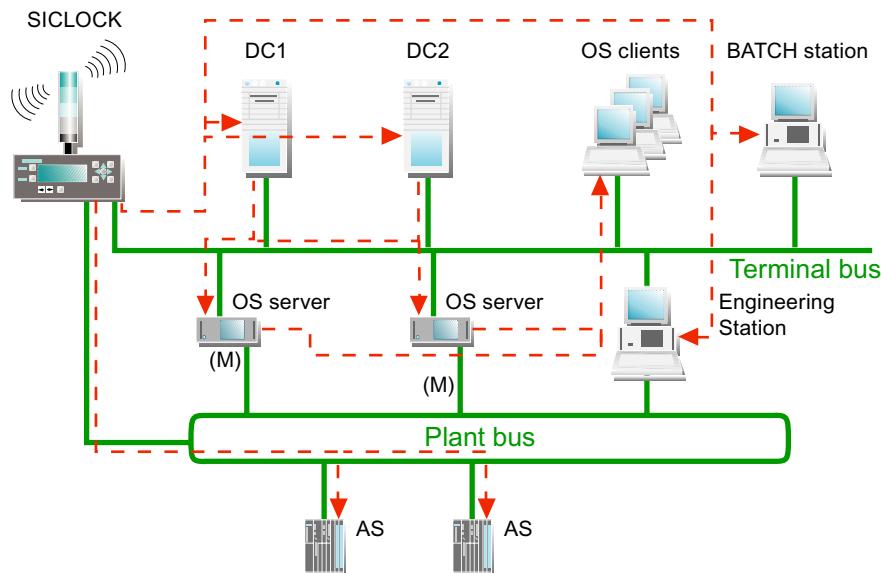
Requirements

- All operator stations must be installed in one domain.
- The SICLOCK TC 400 must be connected to the terminal bus and the plant bus.
- For the CP of the OS server the "Time tracking" option is selected in NetPro.
- The OS server must be equipped with a communication module:
  - CP 1613 or CP 1623 (more than 8 AS or high-availability AS)
  - BCE (up to 8 AS)
- All automation systems must be configured as time slaves (exceptions: CPU 416-3 PN/DP, CPU 414-3 PN/DP).

Configuring the OS server for time synchronization

To configure time synchronization for the OS server, proceed as follows:

1. Open the OS server in the PCS 7 project on the engineering station.

2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
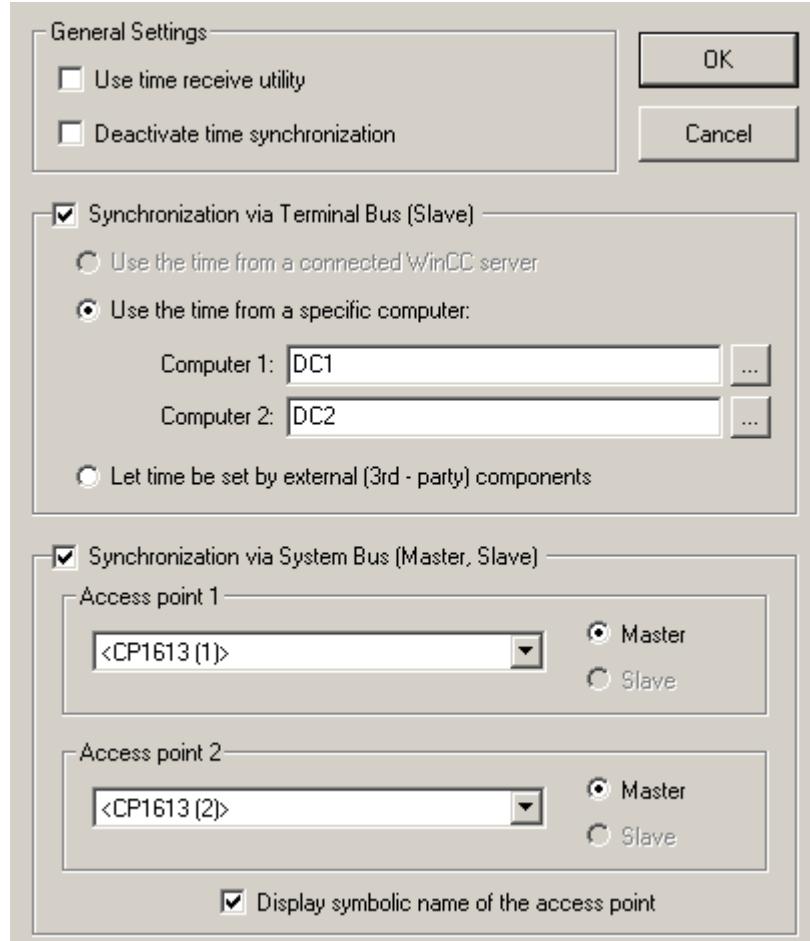
4. Select the check box "Synchronization via terminal bus (slave)".
   Thus all associated check boxes and text boxes are active.

5. Select the "Accept time from permanently defined computers".

6. In the "Computer 1" text box, enter the first domain controller (DC1) and enter the redundant domain controller (DC2) in the "Computer 2" text box.

7. Select the check box "Synchronization via plant bus (master/slave)".
   Thus all associated check boxes and drop-down list boxes are available for selection.

8. Select the check box "Display symbolic names of the access points". This will display the communication modules of the OS server with symbolic names, if they are not available on the engineering station.

9. Select the required CP from the "Access point 1" drop-down list box. The list shows all devices installed on the computer or the symbolic names that are suitable for time synchronization.

10. Select the "Master" check box.

11. If using a redundant CP, select the required CP from the "Access point 2" drop-down list box.

12. Activate the "Master" option button (default setting).
    This defines the OS server as the time master.

13. Click "OK".

Configuring the OS client for time synchronization

The OS clients only have simple network cards that neither send nor receive time message frames. They query the time from the OS server in cycles and set their time accordingly. OS clients query the time only from those OS servers from which they loaded data.

To configure OS clients for time synchronization, proceed as follows for each OS client:

1. Open the OS client in the PCS 7 project on the engineering station.

2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
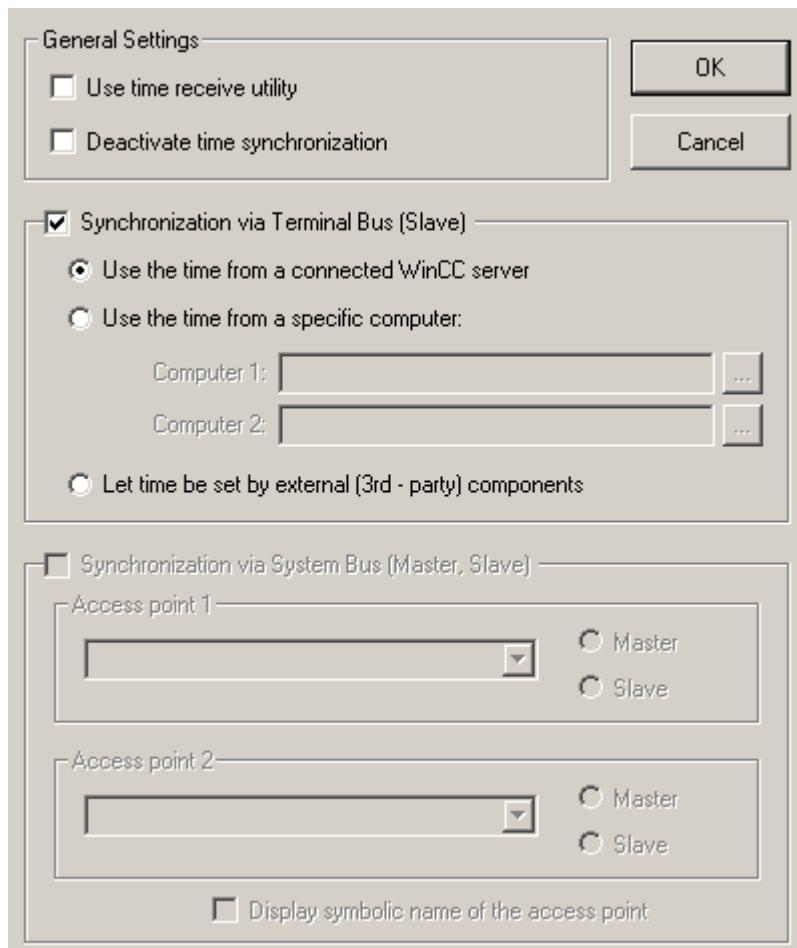
4. Select the check box "Synchronization via terminal bus (slave)".
   Thus all associated check boxes and text boxes can be selected.

5. Select the "Use time from a connected WinCC server" check box.

6. Click "OK".

Execute these steps for every OS client that will be synchronized.

Configuring time-of-day mode for a communications processor (CP 1613, CP 1623)

To configure time-of-day mode for the communications processor, proceed as follows:

1. Open SIMATIC Manager.

2. Select the station to be synchronized from the tree view.

3. Open the configuration of the station.

4. Select the communications processor (CP 1613, CP 1623).

5. Select **Edit > Object Properties**.
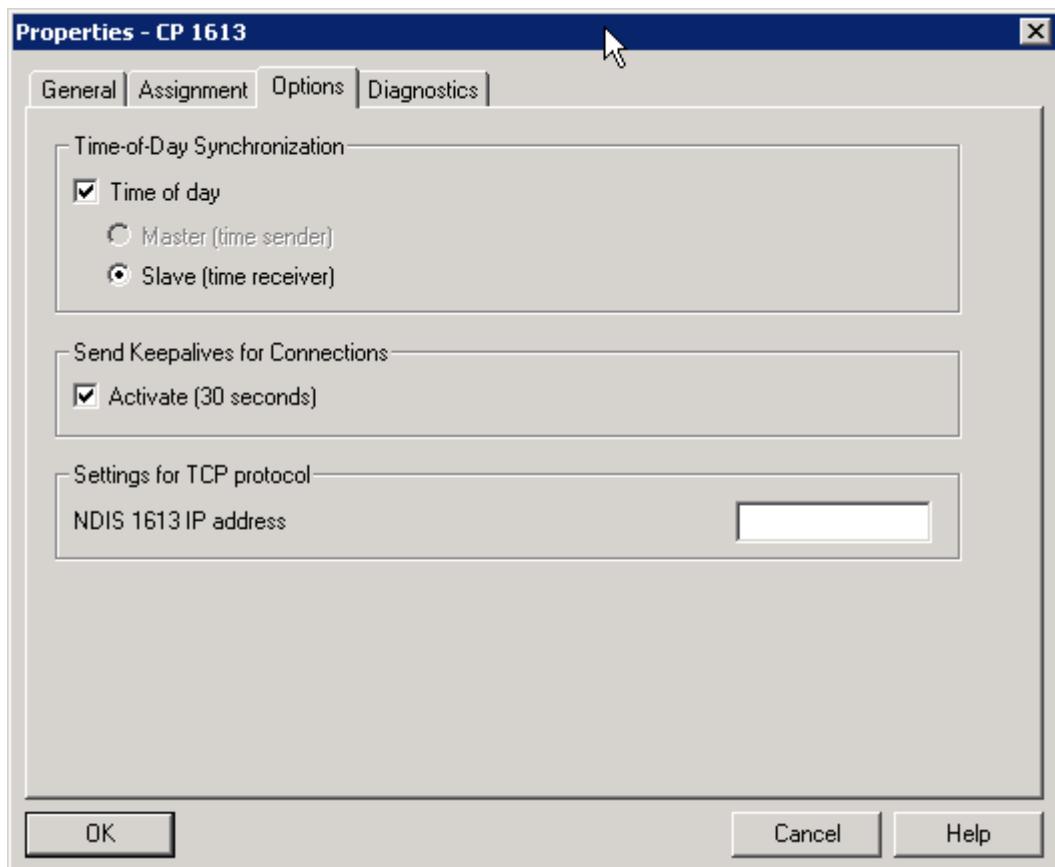
6. Switch to the "Options" tab.

7. Activate the "Time of day" check box.

8. Click "OK".

Rules

> **Note**
>
> Comply with the following instructions for the time synchronization settings on the OS:
> - We recommend parameterizing all OS servers as cooperative time masters.
> - During configuration, select the "Use symbolic names" check box. This will display the network cards that are installed on the OS. However, symbolic names are converted on the OS in process mode.
> - To synchronize the time via the plant bus, configure a device via "Access point 1". In the following cases configure a second device via "Access point 2".
>   - If you want to use a redundant device.
>   - If you want to synchronize two plant busses via one "bridge".
>   - If you want to synchronize two plant buses as time masters at the same time.
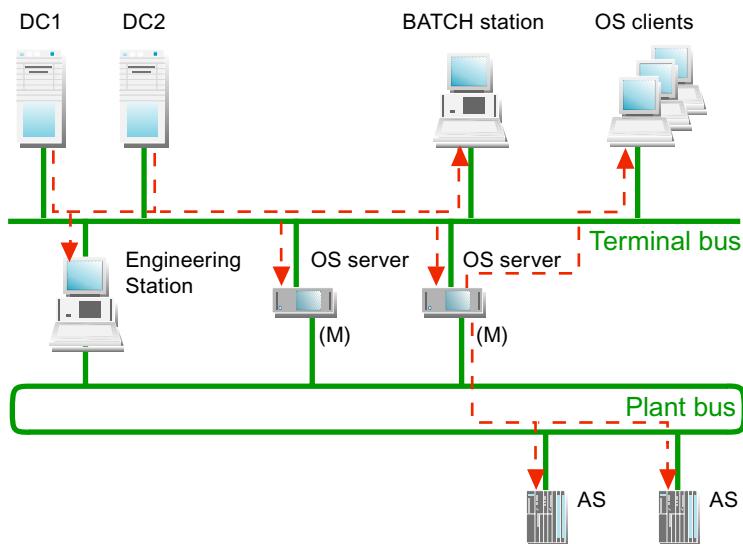
> **Note**
>
> **OS servers in a Windows domain**
>
> Before you set the time synchronization parameters for a PCS 7 system in a Windows domain, create a detailed plan of your network structure. This plan must contain all the relevant information for time synchronization:
> - Which computer is the domain controller?
> - Which computers belong to the Windows domain and receive their time from the domain controller?
> - Which computers do not belong to the Windows domain and where do they obtain their time from?
> - Which computers are time masters and which are time slaves?

5.5.5 How to set time synchronization on an OS in a domain without central time master

Example configuration

Note

CPU types with an integrated Ethernet interface cannot be used in this configuration.

Requirements

- All automation systems must be configured as time slaves.
- An NTP time server must be connected.
- The domain controller must be configured as the master of the main structure.

Configuring the OS server for time synchronization

In this configuration, use the NTP time server as the time source instead of a central plant clock. The NTP time server is a reliable time source with the DCF 77 reception module or GPS receiver module. Time master is the domain controller. The parameter assignment of the domain controller as time master is described in the Microsoft literature at the Internet address: (http://support.microsoft.com/kb/816042/en-us) .

To assign parameters for the OS server additionally as time slaves of the domain controllers, proceed as follows:

1. Open the OS server in the PCS 7 project on the engineering station.

2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
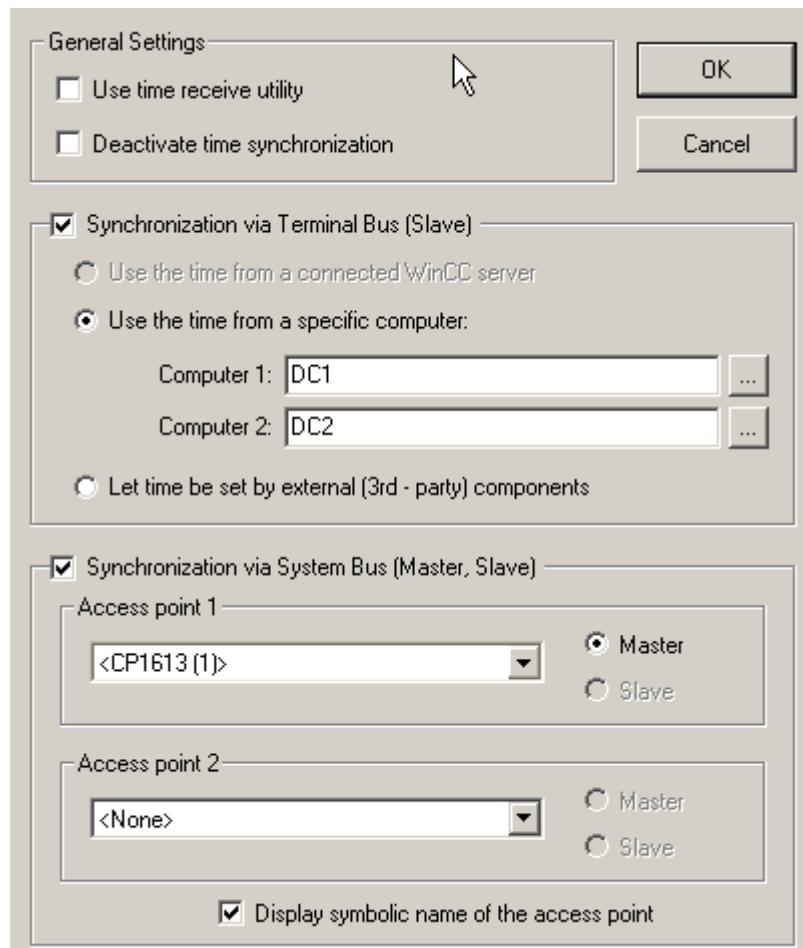
4. Select the "Synchronization via terminal bus (slave)" check box.

5. Activate the "Accept time from permanently defined computers" check box and select for "Computer 1" the domain controller that is parameterized as the time master.

6. For "Computer 2", select an additional domain controller to act as a passive time master if redundancy is possible.

7. Select the "Synchronization via plant bus (master, slave)" check box.

8. Select the check box "Display symbolic names of the access points". This will display the communication modules of the OS server with symbolic names, if they are not available on the engineering station.

9. Select the CP you parameterized for time synchronization from the "Access point 1" drop-down list box.

10. Activate the "Master" option button.

11. If using a redundant CP, select the required CP from the "Access point 2" drop-down list box.

12. Activate the associated "Master" option button (default setting).

13. Click "OK".

Perform these steps for every OS server that you wish to synchronize.

Configuring OS clients for time synchronization

To configure time synchronization for the OS clients, proceed as follows:

1. Open the OS client in the PCS 7 project on the engineering station.

2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
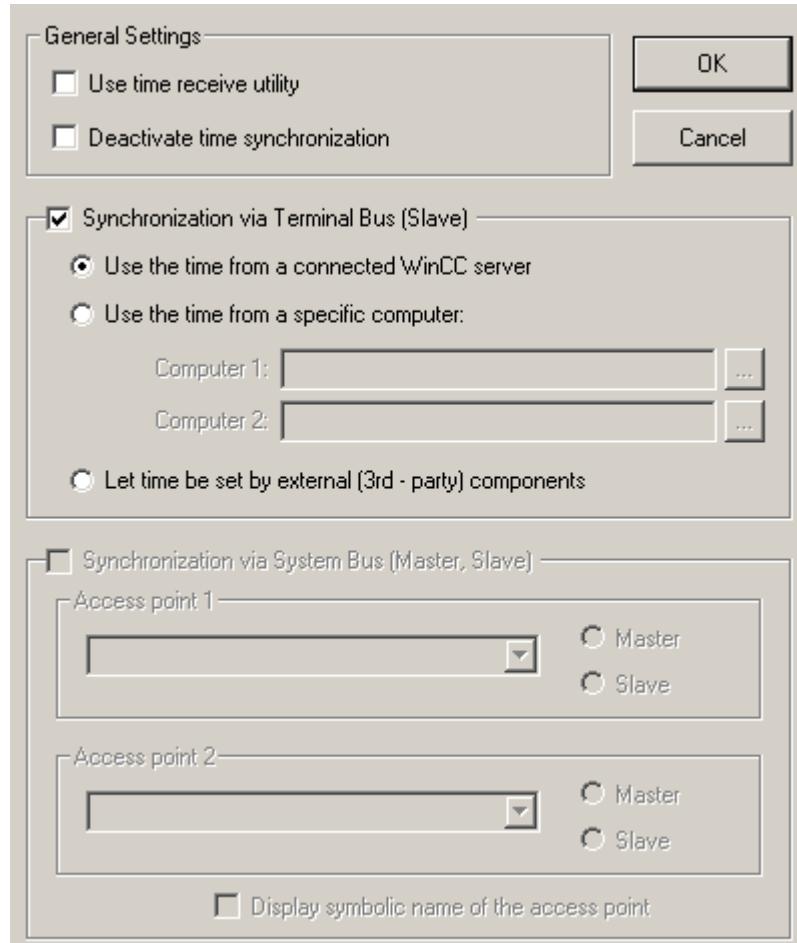
4. Select the "Synchronization via terminal bus (slave)" check box.

5. Select the "Use the time from a connected WinCC server" check box.

6. Click "OK".

Perform these steps for every OS client that you wish to synchronize.

Result

The communication module will now receive and send time message frames. The OS servers are cooperative time masters. If a communications processor (CP1613, CP 1623) does not receive a time signal, WinCC time synchronization automatically switches to master mode. It will then send substitute time signals for the failed time master.

Rules

> **Note**
>
> The automation system can only be synchronized if at least one OS server is activated.

> ⚠ **CAUTION**
>
> If a time jump of more than 5 seconds takes place on the OS server in the UTC, then the OS server configured as time master will no longer be used as time master. In addition the I&C system message "Time synchronization has been permanently deactivated" will be output.
>
> Note that also after a restart this server is no longer defined as time master. Reconfigure the OS server as time master and load the configuration on the OS server.

5.5.6 How to set the OS server for reception of time service via DCF77RS

Requirements

- The DCF 77 receiver (DCF77RS) must be connected directly to a PC.
- In the Control Panel the COM interface must be set for the DCF 77 receiver.
- The extended FIFO setting must be switched off.
- The DCF 77 reception service must be installed, parameters must have been assigned, and it must have been started.

  You can find additional information on the installation of the DCF 77 reception service in section "Commissioning the DCF 77 receiver (Page 69)".

Procedure

To set the OS server for reception of the time service via DCF 77, proceed as follows:

1. Open the OS server in the PCS 7 project on the engineering station.
2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.

3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
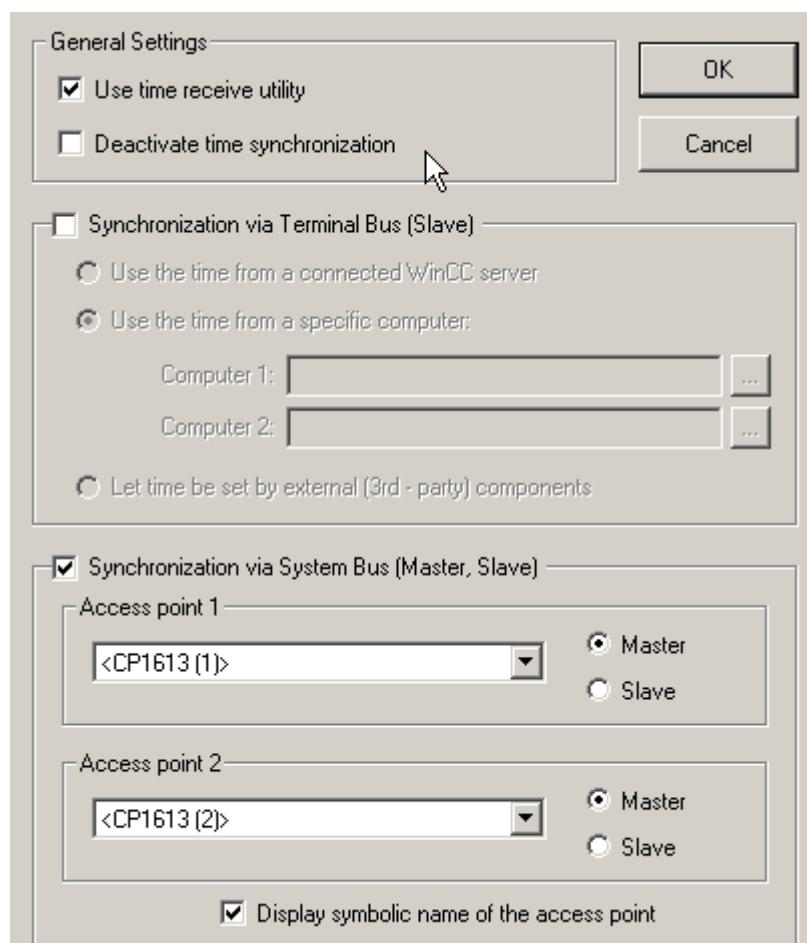
4. Select the "Use time reception service" check box.

5. Select the "Synchronization via plant bus (master, slave)" check box.

6. Go to the "Access point 1" drop-down list box and select the CP for which you have activated time synchronization in the configuration console.
   Here all CP are displayed that are available in the OS server.

7. Select the "Master" option button.

8. If using a redundant CP, select the required CP from the "Access point 2" drop-down list.

9. Select the "Master" option button.

10. Click "OK".

5.6 Configuring time synchronization for a PC station without OS

5.6.1 Overview of configuration steps

Introduction

In PCS 7, operator stations offer an integrated time synchronization option in the form of the "WinCC time synchronization" application. PC stations without OS include, for example:

- Engineering stations
- SIMATIC BATCH stations without OS
- SIMATIC Route Control stations without OS

If SIMATIC BATCH or SIMATIC Route Control is installed on the operator station, the PC station is synchronized via the time synchronization facility of the OS.

The following time synchronization options are available for PC stations without OS:

- Recommended: DCF77 Client Service
  You synchronize the PC stations directly with a time master (e.g. central plant clock, domain controller, operator station).
  The central plant clock can be synchronized via GPS.

- Synchronization via NTP mode
  You will find additional information on this topic in Section "How to synchronize PC stations using NTP mode (Page 121)".

Configuration steps for PC stations with DCF77 Client Service

The following table shows which configuration steps are necessary to synchronize the PC stations:

Step	What?
1	Install the DCF77 Client Service
2	Configure the DCF77 Client Service

5.6.2 How to make DCF 77 Client Service settings on a PC station without OS

Introduction

If no operator station is being used on a PC station in process mode, this PC station should be synchronized by means of the "DCF 77 Client Service" software, which you will need to install.

The "DCF 77 Client Service" software is available in the "Additional Products" folder on the toolset DVD.

Requirement

- The "DCF77 Client Service" software must be installed.
  You will find additional information on this topic in Section "Configuring the DCF 77 Client Service".

- The settings are made on the relevant PC station.

Procedure

1. Select **Start > Settings > Control Panel** from the Windows Start menu.
   The "Control Panel" dialog box opens.
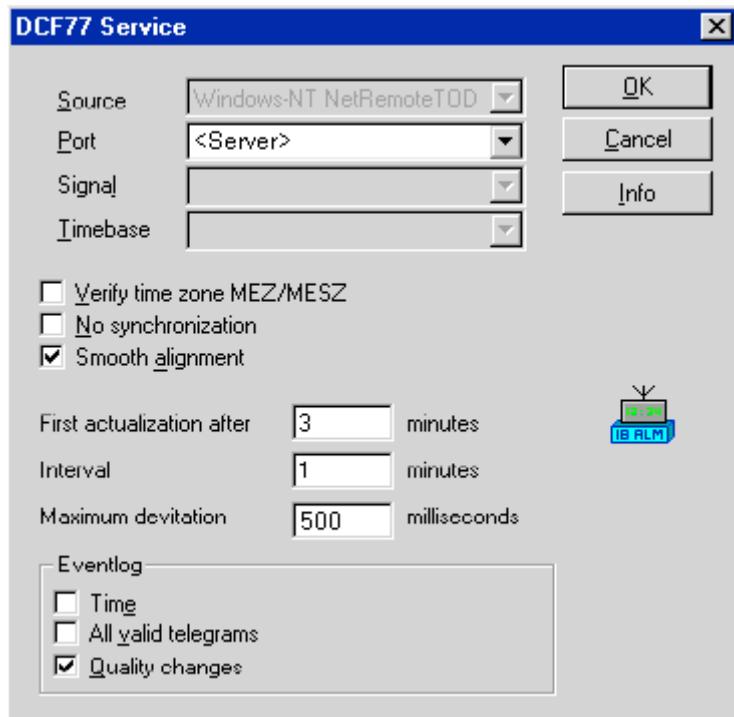
2. Double-click the "DCF 77" object.

   The "DCF 77 Service" dialog box opens.

3. Select the server that is configured as the time master from the "Port" drop-down list box.

4. Click "OK".

5.6.3   How to set time synchronization on a BATCH/operator station

Procedure

If SIMATIC BATCH is installed on the operator station, it will be synchronized via the WinCC time synchronization. The procedure for this is described in the section "Configuring time synchronization of the OS (Page 71)".

5.6.4   How to set time synchronization on a route control/operator station

Procedure

If SIMATIC Route Control is installed on the operator station, it will be synchronized via the WinCC time synchronization. The procedure for this is described in the section "Configuring time synchronization of the OS (Page 71)".

5.7 Time synchronization via conventional point-to-point connections

5.7.1 Configuring directly connected time receivers

Overview of commissioning tasks

The table below shows the commissioning tasks that are needed to connect a time receiver directly to an operator station for the purpose of time synchronization:

Step	What?
1	Install the DCF 77 reception service
2	Connect the receiver cable
3	Align the antenna
4	Set DCF 77 reception service after commissioning

Installing the DCF 77 reception service

Connect the time receiver to the selected COM interface (RS 232) on the relevant operator station. The time receiver is supplied with power via the COM interface.

Install the supplied "DCF 77 reception service for Windows" software on the PC station that is connected to the DCF 77 receiver:

1. Switch the PC on.

2. Insert the diskette/CD with the driver software into the drive.

3. Start the SETUP.EXE file

4. Follow the installation instructions.

   The DCF 77 receiver service is stored as an icon in the Control Panel. The DCF 77 reception service is launched automatically once the system has started up.

5. Activate the DCF 77 reception service in the Control Panel.

**Setting the DCF 77 reception service for commissioning**

To commission the DCF 77 reception service, proceed as follows:

1. Select **Start > Settings > Control Panel** from the Windows Start menu on your PC station.
   The "Control Panel" dialog box opens.

2. Double-click the "DCF 77" object.

   The "DCF 77 Reception Service" dialog box opens.

3. Select the COM interface to which the external time receiver is connected.
   Default: COM2

4. Set the signal form prescribed by the time receiver manufacturer.
   Example: DCF77 demodulated

5. Select the following check boxes in the "Eventlog" area:

   – Time

   – All valid telegrams

   – Quality changes
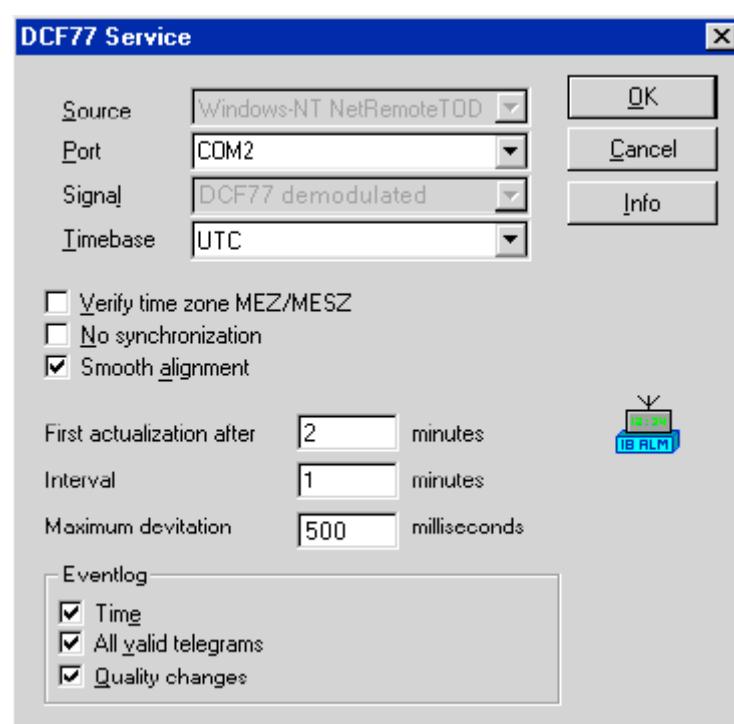
6. Click "OK".

Aligning the antenna

To optimally align the time receiver, proceed as follows:

1. Configure the time receiver so that the control LED flashes every second.

Note

If you do not get clear reception then note the following rules:
- Maintain as great a distance as possible between the time receiver and PC, monitors, laser printers, motors, motorized drives, or similar sources of interference.
- Keep the time receiver away from metal surfaces and steel-reinforced concrete.

Note

Additional instructions on the connection and optimal alignment of the time receiver can be found in the relevant Operating Instructions.

## Setting the DCF 77 reception service after commissioning

To set the DCF 77 reception service after commissioning, proceed as follows:

1. Select **Start > Settings > Control Panel** from the Windows Start menu on your PC station. The "Control Panel" dialog box opens.

2. Double-click the "DCF 77" object.

The "DCF 77 Reception Service" dialog box opens.

3. Deselect the "Time" and "All valid telegrams" check boxes in the "Event log" area:
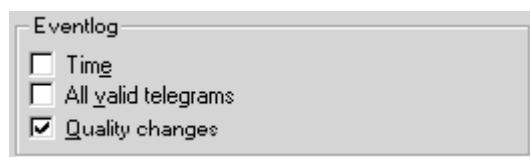
5.8 Configuring time synchronization on an AS

5.8.1 How to set time synchronization on an AS for SIMATIC mode

Requirements

- An automation system with a CP 443-1, CP 443-5 Extended that is capable of time synchronization must be used.
- A CPU capable of time synchronization is used for the SIMATIC mode.
- An external time sender must be the time master.
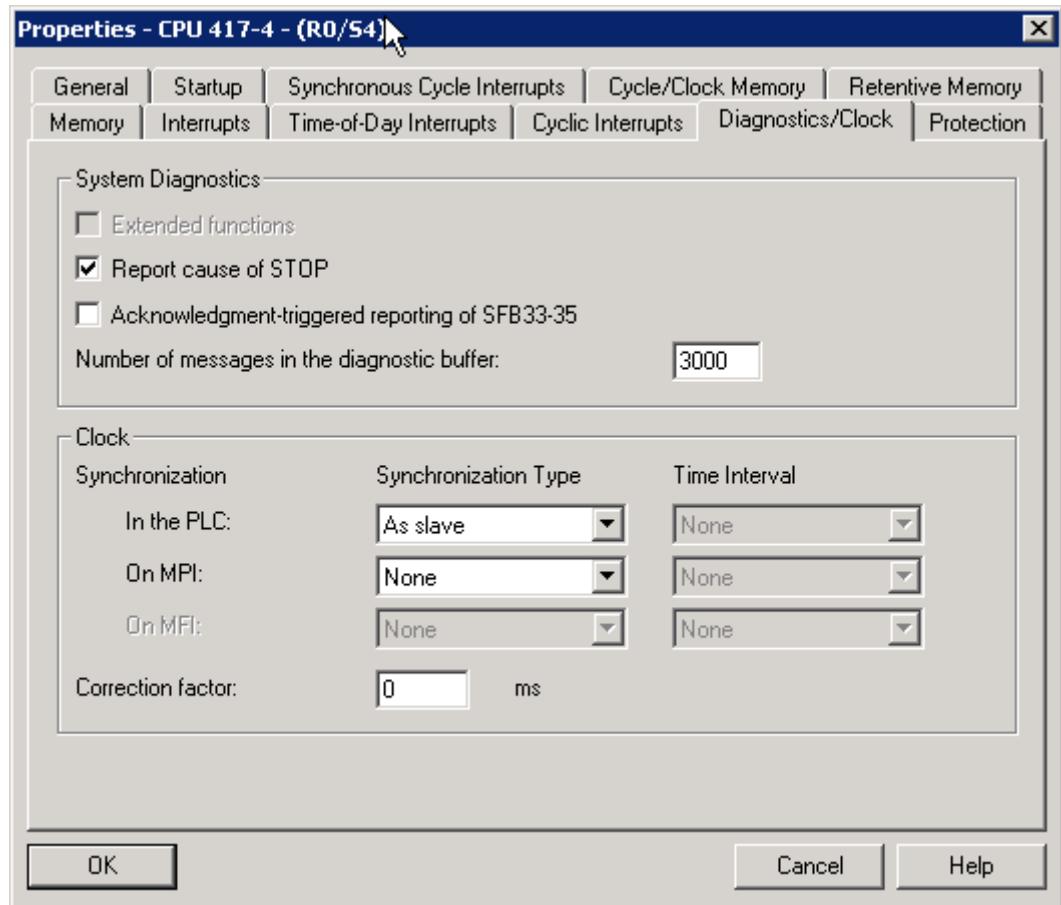
Setting the CPU

To configure time synchronization for the CPU, proceed as follows:

1. Open the project in SIMATIC Manager.
2. Select the station that will be synchronized.
3. Open the configuration of the hardware.
4. Select the CPU, followed by **Edit > Object properties**.
   The "Properties - CPU..." dialog box opens.

5. Go to the "Diagnostics/Clock" tab.

6. In the "Clock" group select the following:
   – For "Synchronization in the AS" select the synchronization mode "As slave".
   – For "Synchronization to MPI" select the synchronization type "None"
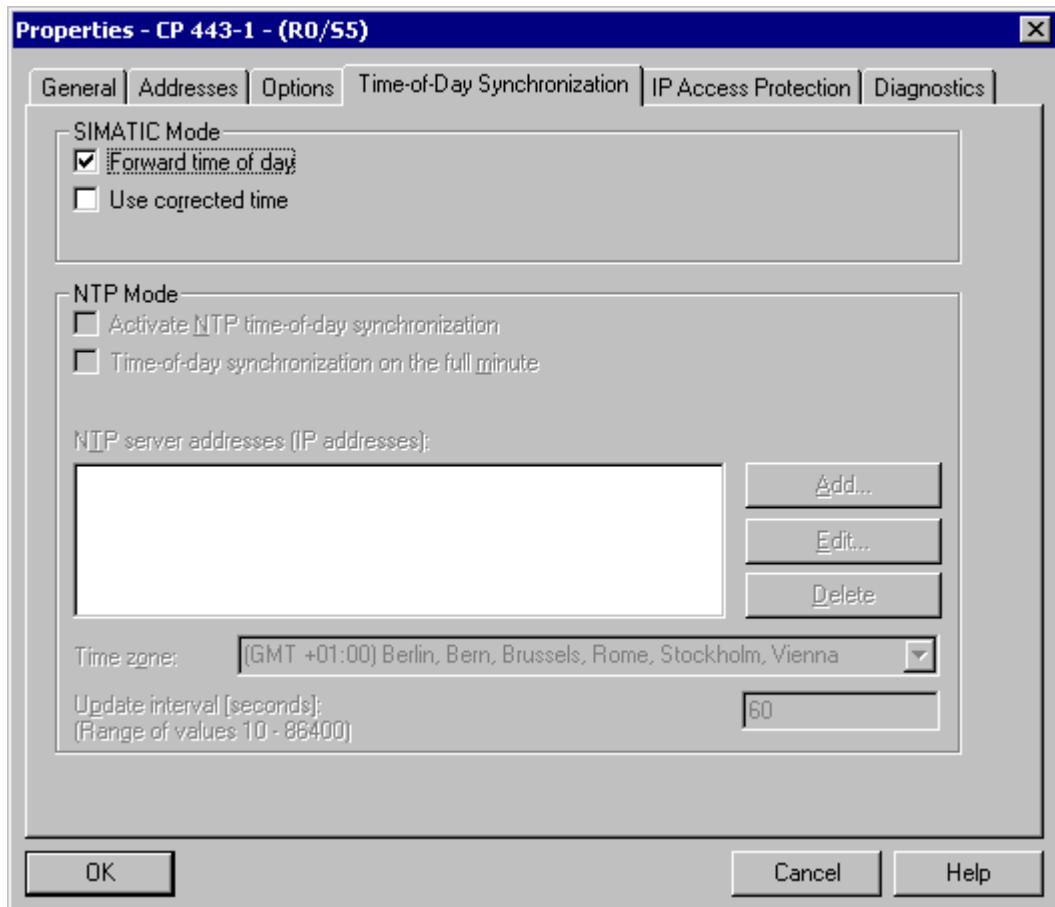7. Click "OK".

Result

The automation system is configured for time synchronization as a time slave.

Setting CP 443-1 (Industrial Ethernet)

To configure time synchronization for the CP443-1, proceed as follows:

1. Open the project in SIMATIC Manager.

2. Select the station that will be synchronized.

3. Open the configuration of the hardware.

4. Select the CP 443-1, followed by **Edit > Object Properties**.
   The "Properties - CP 433-1" dialog box opens.

5. Switch to the "Time-of-Day Synchronization" tab.

6. Activate the "Forward time" check box in the "SIMATIC mode" group.

Note

These settings are available for older versions of the CP 443-1 (<EX11) on the "Options" tab under "Switch on time synchronization".

7. Click "OK".

If you are operating with several SIMATIC 400 stations, repeat this procedure for each CP.

Result

The communications processor uses the SIMATIC mode for time synchronization.

Note for redundant systems

If in a SIMATIC H-station (high-availability process control systems) multiple CPs are present that are connected to the same network, then time synchronization can only be switched on for one of these CPs. The following table shows the possible arrangement:

Plant bus	CPU 1/rack 1		CPU 2/rack 2	
Plant bus 1	CP 1/1	Time synchronization enabled	CP 1/2	Time synchronization disabled
Plant bus 2	CP 1/2	Time synchronization disabled	CP 2/2	Time synchronization enabled

Setting CP 443-5 Extended (PROFIBUS DP)

To configure time synchronization for the CP443-5 Extended, proceed as follows:

1. Open the project in SIMATIC Manager.

2. Select the station that will be synchronized.

3. Open the configuration of the hardware.

4. Select the CP 443-5 Extended, followed by **Edit > Object Properties**.
   The "Properties - CP 443-5 Ext" dialog box opens.
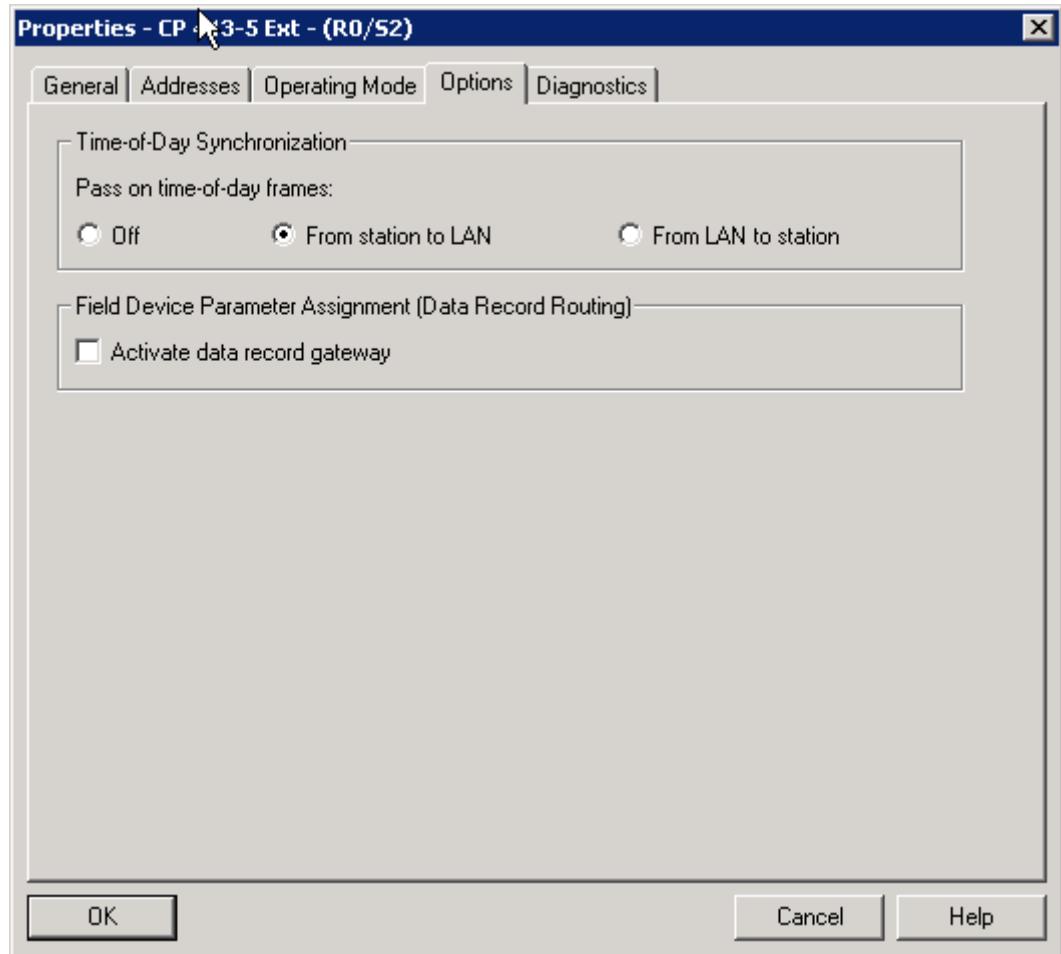
5. Switch to the "Operating Mode" tab.

6. Activate the "DP master" option button.
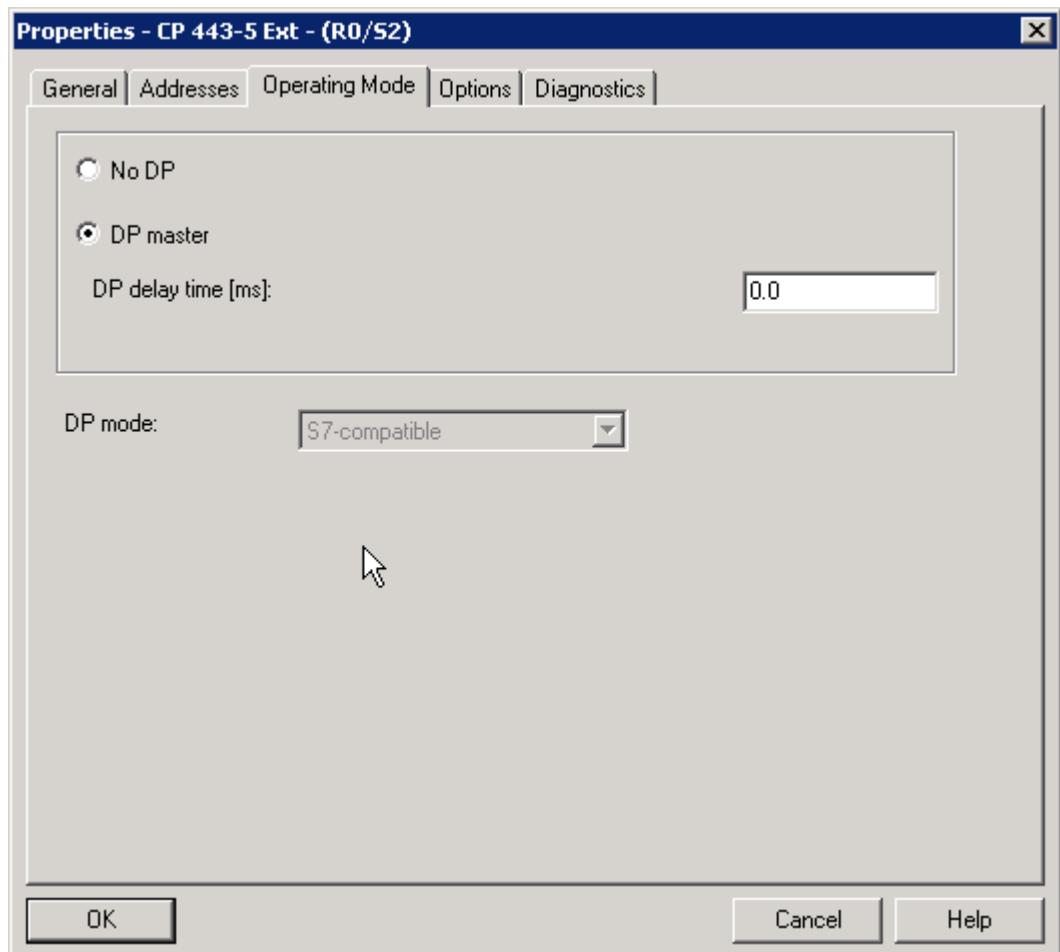
7. Switch to the "Options" tab.

8. Activate the "From station to LAN" option button in the "Time-of-Day Synchronization" group.

9. Click "OK".

Result

The time message frames of the time master are forwarded to the automation systems on the plant bus.

Rule

Note

Please note the following:

- The CPU with integrated Ethernet interface can only be synchronized via the NTP mode. You can find additional information about this in the section "How to set time synchronization on an AS for NTP mode (Page 105)".
- For all other CPUs we recommend that you continue to use the SIMATIC mode.

5.8.2 How to set time synchronization on an AS for NTP mode

The CPU with integrated Ethernet interface can only be synchronized via the NTP mode. We recommend using a SICLOCK TC 400 as an external clock. Please note the following restriction that is applicable in this case: The SICLOCK supports a maximum of 50 NTP requests/sec. In the case of previous CPUs, we recommend that you continue to use S7 mode. These CPU types must not be used in PCS 7 configurations with only a plant bus (and without a terminal bus).

The following describes the configuration of the time synchronization for the CPU types with integrated Ethernet interface.

Requirements

- These CPUs can only be used in PCS 7 configurations with a plant bus and a terminal bus.

- CPU with integrated Ethernet interface
  Example:
  - CPU 416-3 PN/DP
  - CPU 414-3 PN/DP

Setting the CPU

1. Open the project in SIMATIC Manager.

2. Select the station that will be synchronized.

3. Open the configuration of the hardware.

4. Select the CPU, followed by **Edit > Object properties**.
   The "Properties - CPU..." dialog box opens.

5. Go to the "Diagnostics/Clock" tab.
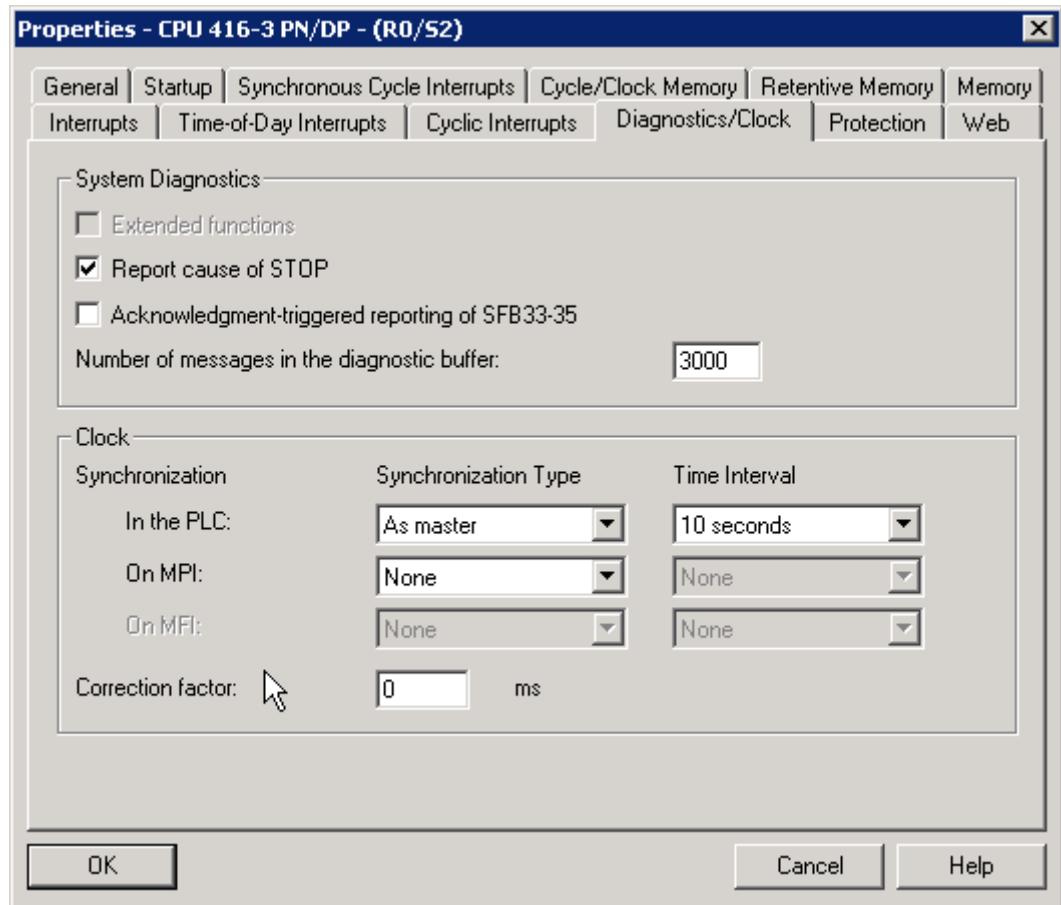
6. In the "Clock" group select the following:

    – Synchronization method "As master" and a time interval of "10 seconds" for "in AS" synchronization

    – Synchronization method "None" for "on MPI" synchronization
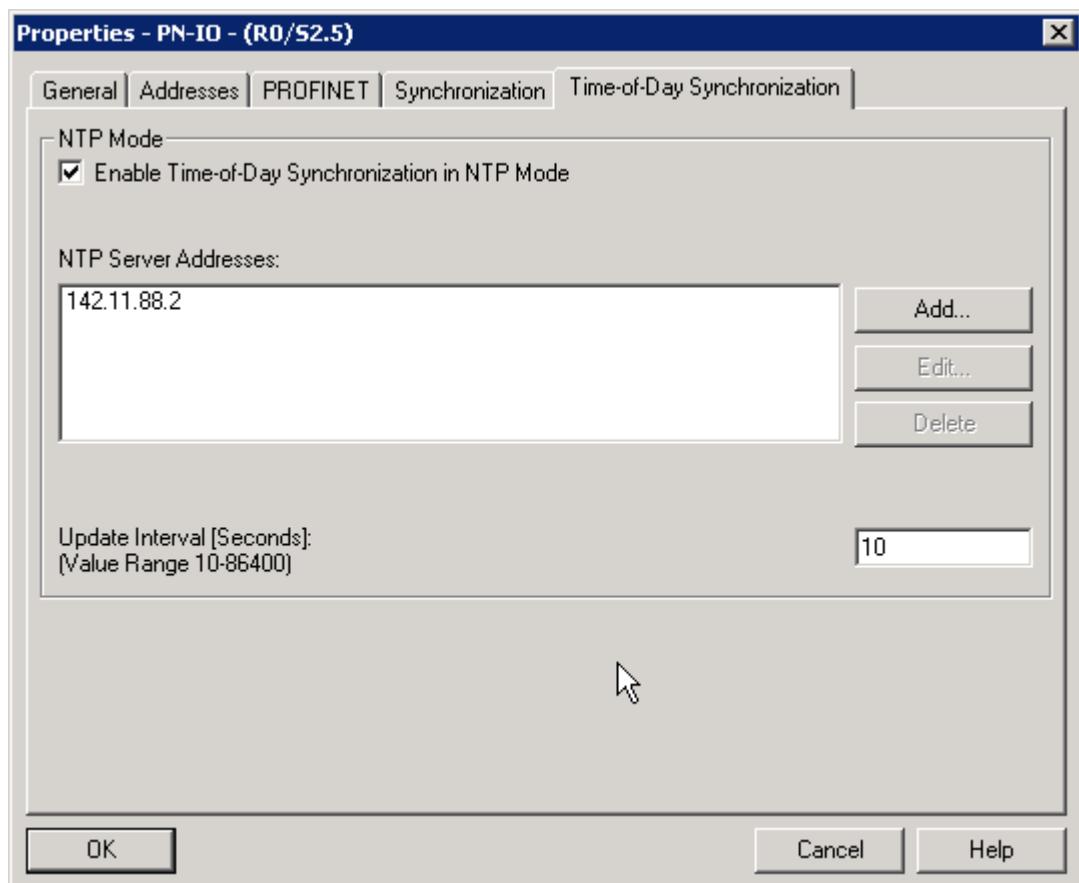
7. Click "OK".

Result

The automation system is configured for time synchronization as the time master.

Setting the integrated Ethernet interface

To set the integrated Ethernet interface for time synchronization, proceed as follows:

1. Open the project in SIMATIC Manager.

2. Select the station that will be synchronized.

3. Open the configuration of the hardware.

4. Select the PN-IO interface, followed by **Edit > Object properties**.
   The "Properties PN-IO" dialog box opens.

5. Switch to the "Time-of-Day Synchronization" tab.

6. Activate the "Enable Time-of-Day Synchronization in NTP Mode" check box in the "NTP Mode" group.

7. Enter the IP address of the central plant clock (SICLOCK TC 400 or SICLOCK TM) as the NTP server address.

8. Enter the value "10" in the "Update Interval (Seconds)" field.

9. Click "OK".

Result

The automation system uses NTP mode for time synchronization.

Further information

A list of CPU types that have an integrated Ethernet interface is provided in the documentation *PCS 7 Process Control System; Released Modules*.

5.9 Configuring time synchronization for the SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX

5.9.1 Overview of time synchronization for the SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX

Options

The following aspects are relevant for the SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX in terms of time synchronization:

- Type of automation system

- Installed software

- Settings for the time zone and daylight saving time/standard time conversion in Windows

- Selection of the synchronization source for the automation system (WinAC time synchronization)

- Settings for the time base in WinCC for the automation system and process mode of the operator station

Plant-specific assignment of time synchronization parameters for the SIMATIC PCS 7 BOX and SIMATIC PCS 7 AS RTX

In PCS 7, time synchronization of the SIMATIC PCS 7 BOX/SIMATIC PCS 7 AS RTX is dependent on the plant configuration. The following table shows the settings required for time synchronization.

Settings to be made in following environment	PCS 7 network Synchronization via plant bus (external)	Single station system Synchronization via BIOS time (local)	
	The displayed time should match the synchronization source specifications.	The displayed time should match the local time. Possible to switch between daylight saving time/standard time. A continuous time should be set on the AS (GMT/UTC).	The time should be displayed uniformly across all levels and functions. **Note:** Daylight saving and standard time must be set manually. Please contact Customer Support regarding automatic switchover.
WinAC time synchronization Settings (Page 111):	Source: CP	Source: PC	Source: PC
		Time base: GMT	Time base: Local
Windows setting Date and time properties > "Time Zone" tab Settings (Page 54):	Time zone: Local time zone	Time zone: Local time zone	Time zone: Greenwich Mean Time (GMT)
	Select switchover between daylight saving and standard time on a plant-specific basis		"Automatically adjust clock for daylight saving changes" check box deactivated
WinCC Explorer "Computer" object properties > "Parameters" tab (Page 113)	Option button "The PLC is set to coordinated universal time (UTC) (preferred setting)": Activated		Option button "PLC is set to the local winter time all year": Activated
	"Time base for time display in runtime" group: Local time zone		
WinCC Explorer "Time Synchronization" editor	You will find additional information on plant-configuration-dependent settings under "Configuring the time synchronization of the OS (Page 71)"; Sections:"Configuring the OS client for time synchronization"		

5.9.2   How to set the time synchronization source

Introduction

Make the setting in accordance with the configuration you selected.

Requirements

- WinAC Time Synchronization software V4.0 or higher must be installed on the SIMATIC PCS 7 BOX or SIMATIC PCS 7 AS RTX.

- In HW Config, "As slave" must have been set as the synchronization mode for time synchronization in the AS.

- The Windows settings and settings for the computer object properties in WinCC Explorer must be made.

Synchronizing the SIMATIC PCS 7 BOX or the SIMATIC PCS 7 AS RTX on a network via the plant bus

The CP of the PC station should be set as the source for time synchronization.

1. Select the menu command **Start > SIMATIC > PC Based Control > WinAC Time Synchronization**.
   The "WinAC Time Synchronization" dialog box opens.

2. Activate the "CP" options button under "Source" in the in the "Settings" group.

3. Click "Select".

4. In the "Set PG/PC Interface" dialog box that appears, select the interface connected to the plant bus in the "Interface parameterization used" group.

5. Click "OK" to close the dialog box.

6. Click "OK" to confirm the message that appears.

7. Click "Start" to initiate time synchronization.

8. Click "Close" to close the dialog box.

Synchronizing the SIMATIC PCS 7 BOX or the SIMATIC PCS 7 AS RTX as a single station system using the PC clock

For a single station system, you need to set the PC clock as the source for time synchronization.

1. Select the menu command
   Start > SIMATIC > PC Based Control > WinAC Time Synchronization.
   The "WinAC Time Synchronization" dialog box opens.

2. In the "Settings" group under "Source", click "PC Clock".

3. Select the time base ("Time base" option button) according to the type of time display required:

   – The displayed time should match the local time, including daylight saving changes. A continuous time should be set on the AS (GMT/UTC):
     Time base: GMT

   – The time should be displayed uniformly across all levels and functions: **Time base: Local**
     Note: Daylight saving and standard time must be set manually. Please contact Customer Support regarding automatic switchover.

4. Click "Start" to start the time synchronization.

5. Click "Close" to close the dialog box.

5.9.3 How to set the OS properties

Introduction

PCS 7 OS and the AS are synchronized via the local PC clock.

Requirements

- WinCC Explorer must be open.
- This procedure is only relevant for the SIMATIC PCS 7 BOX.

Procedure

1. Select the "Computer" object from the tree structure in WinCC Explorer.

2. Select **Properties** from the shortcut menu.
   The "Computer List Properties" dialog box opens.

3. Click "OK".
   The "Computer Properties" dialog box opens.

4. Select the "Properties" tab.

5. Make the settings for the time base in WinCC for the AS (PLC) and for process mode of the operator station (runtime), according to the type of time display required:

	PCS 7 network Synchronization via plant bus (external)	Single station system Synchronization via BIOS time (local)	
The time should be displayed as follows:	The displayed time should match the synchronization source specifications.	The displayed time should match the local time. Possible to switch between daylight saving time/standard time A continuous time should be set (GMT/UTC).	The time should be displayed uniformly across all levels and functions. **Note:** Daylight saving and standard time must be set manually.
Parameter	Option button "The PLC is set to coordinated universal time (UTC) (preferred setting)": **Activated**		Option button "PLC is set to the local winter time all year": **Activated**
	"Time base for time display in runtime" group: **Local time zone**		

6. Click "OK".
   The "Computer properties" dialog box closes.

5.9.4 How to configure time synchronization of the AS

Introduction

The following configuration is required for the AS.

Requirements

- The PCS 7 project is created.
- SIMATIC Manager is open.
- The component view is activated

Procedure

1. In the component view, select the SIMATIC PC station.
2. In the detailed view, double-click the "Configuration" object.
   HW Config opens.
3. Select the CPU in the SIMATIC PC station.
4. Open the shortcut menu of the CPU and select the menu command **Object Properties**.
   - Select the "Diagnostics/Clock" tab.
   - Under "Synchronization in AS:" in the clock group, select "As slave" as the synchronization mode.
   - Click "OK".
     The dialog box closed.
5. Select the menu command **Station > Save and Compile**.
6. Close HW Config.

5.9.5 How to set OS time synchronization

Introduction

The PCS 7 OS is synchronized via the local PC clock.

Requirements

- The WinAC Time Synchronization software, Version V4.0 or higher, must be installed on the SIMATIC PCS 7 BOX.
- In HW Config, "As slave" must have been set as the synchronization mode for time synchronization in the AS.

Setting the time synchronization of the OS

Requirements

- WinCC Explorer must be open.
- This procedure is only relevant for the SIMATIC PCS 7 BOX.

Procedure

> **Note**
>
> **SIMATIC PCS 7 BOX on the plant bus (LAN)**
>
> The following steps within this procedure are only required if the PC station is operated on the plant bus (LAN).

1. Select the "Time synchronization" editor in WinCC Explorer.
2. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
3. Activate the "Synchronization via System Bus (Master, Slave)" check box.
4. Activate the "Display symbolic name of the access point" check box.
5. Go to the "Access point 1" drop-down list box and select "<Softnet(2)>": This is to be used for synchronizing the time on the plant bus.
6. Activate the "Slave" option button, as a time master is available.
7. Click "OK".
   The "Time Synchronization" dialog box closes.

Additional information

- Manual *SIMATIC; Windows Automation Center RTX; WinAC RTX*
- Manual *SIMATIC; Windows Automation Center RTX; WinAC Slot*

## 5.10 Configuring time synchronization with multiple networks

5.10.1 Configuring time synchronization for separate networks using a central clock

Introduction

In order to ensure that time synchronization is reliable for separate networks as well, only the time message frame from the central time clock (SICLOCK TC 400 or SICLOCK TM/TS) may be transferred to the networks.

- Use SICLOCK TC 400 to synchronize up to four networks.

- If more than four networks must be synchronized, use a suitable switch such as the SCALANCE X414-3E to separate message frame traffic.

The following example demonstrates synchronization of five networks with a SICLOCK TM central plant clock, using a SCALANCE X414-3E switch.
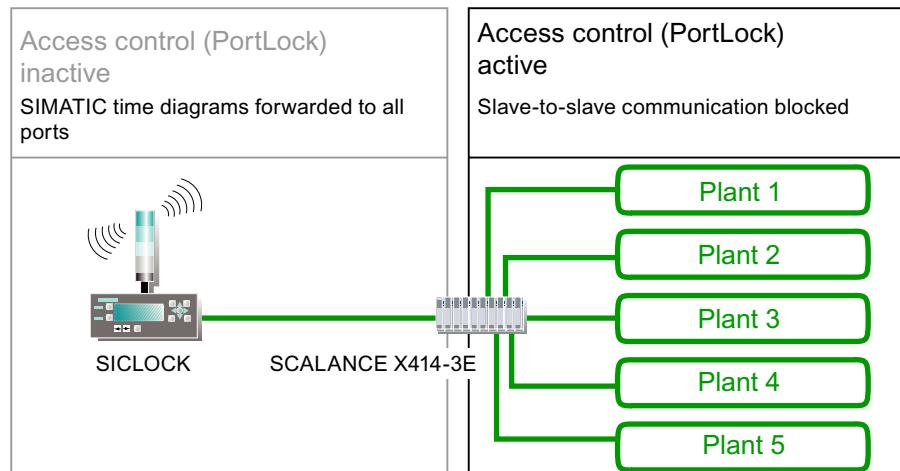
Function for separating message frame traffic

The following function is used to separate message frame traffic between the networks.

- SCALANCE X414-3E switch: Access control
  Configure the switches using web-based management.

- OSM/ESM switch: Port lock
  Configure the switch using Telnet. You can use web-based management if Java is installed on the PC station used for configuration.

Requirements

- The synchronization message frame from SICLOCK must be parameterized.
- The IP address of SICLOCK must be known.
- The SICLOCK (central plant clock) must be connected to a switch.
- The networks (plants 1 to 3 in the example figure) must not be connected to the switch.
- You must configure the switches using web-based management.

Requirements for configuration using web-based management

- The IP address of the switch must be set.
  There must be an Ethernet connection between the switch and PC station.
- Microsoft Internet Explorer V5.5 or higher must be installed on the PC station.
- Access to port 80 or 443 must be possible if a firewall is installed (web-based management is based on access via HTTP or HTTPS).
- Only for OSM/ESM: JavaScript is enabled for the Internet Explorer settings.

Note

Internet Explorer must not be set up so that it has to reload the page from the server each time the page is accessed.
Check the settings in Internet Explorer by selecting **Tools > Internet Options... >** "General" tab > "Temporary Internet files" group > "Settings..." button.
The *Automatically* option button must be activated in the *Check for newer versions of stored pages* area.

Further information

Configure the function for separating message frame traffic according to the switch used. You can find information about this in the following sections:

- Section "How to configure SCALANCE X414-3E for the separation of time signals (Page 118)"
- Section "How to configure an OSM/ESM for separating time signals (Page 120) ".

5.10.2 How to configure SCALANCE X414-3E for the separation of time signals

Requirements

- The IP address or the URL of the switch must be known.

- Requirements for configuration using web-based management must have been met.

Procedure

1. Open Internet Explorer.

2. Enter the IP address or the URL of the switch in the address field of Internet Explorer. The login dialog of web-based management is displayed once a reliable connection has been established to the switch.

3. Select the "Admin" entry in the "LoginID" selection field if you wish to edit the settings of the IE switch (read and write access). You are only granted read access to the configuration data of the switch if you selected the "User" entry.

4. Enter your password. The default passwords (from the delivery condition) apply if you have not yet specified a password:

   – User name: admin - Password: admin

   – User name: user - Password: user

   Note

   You are strongly advised to change the default passwords (using the Command Line Interface - CLI) for security reasons.

   ---

5. Click "OK" to initiate login at the switch.

6. Select the "Switch > Ports" folder from the tree view.
   The "Port Status" menu opens.

7. In the "Port" column, click the number of the port to which part of the plant is connected.
   The "Port Configuration" menu opens.

8. Activate the "Port enabled" check box.

9. Click the "Set Values" button.

10. Connect the networks to the switch.

11. Click "Port".

12. Repeat steps 9 to 11 for the ports of the other plants.

Result

Configuration via Web Based Management (WBM) is complete.

Note

Do not enter any Unicast addresses in the Access Control List (ACL) for the plant ports.

Further information

- Configuration Manual *Industrial Communication; Industrial Ethernet Switches; SCALANCE X300; SCALANCE X400*, chapters "Access Control Port Configuration menu item" and "The Port Status menu item"

5.10.3   How to configure an OSM/ESM for separating time signals

Requirements

- The IP address of the switch must be known.
- The ports to which a plant is connected must be known.

Procedure

1. Select **Start > Run...** in the Windows Start menu.
   The "Run" dialog box opens.

2. Enter the following command in the "Open:" text box:
   cmd

3. Enter the following command:
   telnet <IP address>
   You will be prompted to enter the login name.

4. Enter the following login name:
   admin
   You will be prompted to enter the password:

5. Enter the password (default password in delivery condition: admin).
   The Command Line Interface (CLI) opens.

6. Enter the following command:
   port

7. Enter the following command for an OSM/ESM port connected to a plant:
   lock d <port number>

8. Repeat step 7 for all ports which are connected to plants.

9. Enter the following command:
   Exit

Result

Configuration via Telnet is complete.

Note

Do not enter any Unicast addresses in the PDB for the plant ports.

Further information

User Manual *SIMATIC NET; Industrial Ethernet OSM/ESM Network Management*

5.11   How to synchronize PC stations using NTP mode

Introduction

Any PC station which does not feature an integrated function for time synchronization can be synchronized using NTP mode. NTP mode enables the components to actively fetch the time from an NTP server. On PCS 7 plants, the NTP server takes the form of the SICLOCK TC 400.

Make the settings at the PC station using group policies.

Requirements

- The PC stations must not be synchronized using any other method (e.g. by means of "WinCC time synchronization" on an existing OS installation, or by means of an integrated radio clock).

- The SICLOCK TC 400 must be connected to the terminal bus and configured as an NTP server.

- You must make the settings as a PC station administrator.

- In a domain:
  The local settings must not be overwritten by the group policies of the Windows domain.

Procedure

1. Select **Start > Run...** in the Windows Start menu.
   The "Run" dialog box opens.

2. Enter the following command in the "Open:" text box:
   gpedit.msc
   The "Group Policy Object Editor" opens.

3. In the tree view, select "Policies for Local Computer > Computer configuration > Administrative Templates > System > Windows Time Service > Time Providers".

4. Double-click the "Enable Windows NTP Client" object in the detail view.
   The "Properties of Enable Windows NTP Client" dialog box opens.

5. Select the "Activated" option button.

6. Click "OK".

7. Double-click the "Configure Windows NTP Client" object in the detailed window.
   The "Properties of Configure Windows NTP Client" dialog box opens.

8. Select the "Activated" option button.
   The list displays the current settings.

9. Make the following settings:

   - In the "NtpServer" text box, enter the IP address of the SICLOCK TC 400 central plant clock that is connected to the terminal bus.

   - Select the "NTP" entry from the "Type" drop-down list box.

   - Enter the value "60" in the "SpecialPollInterval" entry field.

10. Click "OK".

5.12 Configuring redundant PCS 7 systems

5.12.1 How to configure time synchronization of OS servers with a redundant communication module and external clock

Introduction

The described configuration is based on redundant OS servers on a redundant plant bus.

Requirements

- Each OS server in a server pair must feature redundant communication modules. Possible types:
    - Two CP 1613 each
    - Two CP 1623 each
- The central plant clock must take the form of the SICLOCK TC 400 or SICLOCK TM.
- WinCC Explorer must be open on one of the OS servers.

Procedure

To synchronize the time on a redundant OS with external clock, follow these steps:

1. Open the OS server in the PCS 7 project on the engineering station.
2. Select the "Time synchronization" editor from the tree view of WinCC Explorer.
3. Select **Open** from the shortcut menu.
   The "Time Synchronization" dialog box opens.
4. Select the "Synchronization via plant bus (master, slave)" check box.
5. From the "Access point 1" drop-down list box, select the communication module for which you have activated time synchronization in the configuration console. The drop-down list box shows all installed devices that are suitable for time synchronization.
6. Select the "Master" option button.
   This defines the OS server as time master.
7. Select the redundant communication module required from the "Access point 2" drop-down list box.
8. Activate the "Master" option button.
   This specifies a redundant communication module for time synchronization, which establishes the connection to the plant bus in the event of the first communication module failing.
9. Click "OK".

5.12.2 How to configure time synchronization on a PCS 7 system with redundant bus system

Overview of configuration steps

The table below shows the steps that are necessary for configuring time synchronization for redundant buses, including references to the sections in this documentation that provide a corresponding description:

Step	What?	For further information, refer to the section:
1	Commission the SICLOCK	"Commissioning the SICLOCK TC 400 (Page 60)" "Commissioning the SICLOCK TM/TS (Page 64)"
2	Connect the GPS decoder to SICLOCK and configure it	"Commissioning GPS receivers (Page 66)"
3	If the central plant clock is a SICLOCK TM/TS: Parameterize the DCF 77 reception service on the domain controller • Installing and configuring "DCF 77 reception service for Windows" • Port/interface: COM1 or COM2 • Time Base: Local Time	"Commissioning the DCF 77 receiver (Page 69)"
4	Connect the SICLOCK to the plant bus, depending on the configuration selected: • Via Ethernet for high-availability redundant buses • Via SCALANCE for separated plant buses	"Overview (Page 25)"
5	Configuring time synchronization for automation systems in HW Config	"Configuring time synchronization on an AS (Page 99)"
6	Configuring OS servers with WinCC editor "Time Synchronization"	"Configuring the time synchronization of the OS (Page 71)"
7	Configuring OS clients with WinCC editor "Time Synchronization"	"Configuring the time synchronization of the OS (Page 71)"

5.13 Configuring time synchronization of the domain controller (DC)

5.13.1 How to configure time synchronization of the domain controller

Time synchronization options with a central plant clock

In PCS 7, domain controllers are synchronized with the following central plant clocks as standard:

- SICLOCK TC 400:
  Synchronization via NTP mode; For parameter assignment information, see Section "How to synchronize PC stations using NTP mode (Page 121)"

- SICLOCK TM/TS:
  Synchronization via "DCF77 reception service for Windows" software; described below

Procedure

1. Select **Start > Settings > Control Panel > System** from the Windows Start menu on your PC station.
   The "System Properties" dialog box opens.

2. Select the "Hardware" tab.

3. In the "Device Manager" area, click the "Device Manager" button.

4. In the tree view, select the "Ports (COM & LPT) > Communications Port (COM 1)" folder.
   Note: Select the COM interface to which the SICLOCK TM/TS is connected.

5. In the shortcut menu, select the menu command "Properties".
   The "Communications Port (COM 1) Properties" dialog box opens.

6. Select the "Connection Settings" tab.

7. Click "Advanced".
   The "Advanced Settings for COM1" dialog box opens.

8. Deselect the "Use FIFO buffer" check box.

9. Click "OK".

10. Click "OK".
    The "Communications Port (COM 1) Properties" dialog box closes.

11. Connect the SICLOCK TM/TS to the selected COM interface (RS 232) on the relevant domain controller.

12. Switch the PC on.

13. Insert the disk/CD containing the "DCF77 reception service for Windows" software (supplied with the SICLOCK TM/TS) into the drive.

14. Start the SETUP.EXE file

15. Follow the installation instructions.

16. The DCF 77 reception service appears as an icon on the Control Panel. When the domain controller is restarted, the DCF 77 reception service is launched automatically.

17. Select **Start > Settings > Control Panel** from the Windows Start menu on your PC station. The "Control Panel" dialog box opens.

18. Double-click the "DCF 77" object.

The "DCF 77 Reception Service" dialog box opens.

19. Select the COM interface to which the SICLOCK TM/TS is connected.

20. Set the signal form prescribed by the manufacturer of the DCF 77 receiver.
    Example: DCF77 demodulated

21. Make the following settings:

    – In the "Event log" area, activate the "Changes in signal quality" check box.

    – In the "Event log" area, deactivate the "Time" check box.

    – In the "Event log" area, deactivate the "All valid telegrams" check box.
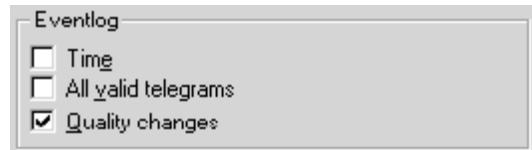
22. Click "OK".

Checking time synchronization

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6.1 How to check the time of the PC stations

Introduction

The following control system message is displayed if time synchronization is disturbed at an OS, for example:

"LAN-Sync: Time synchronization with PC <xxx> is disturbed".

Requirement

It must be possible to operate the operating system environment.
It must not be possible to execute the w32tm function if command prompts have been disabled in the process mode (runtime) configuration. If you wish to use this function, you must change the configuration for process mode.

Methods for checking the time

You can check the time of PC stations in the PCS 7 plant by using the operating system function "w32tm". Use the "w32tm" operating system function to set the time difference to an additional computer.

Note

Further information about the w32tm command is available by entering the string "w32tm/?" in the Windows command prompt.

Checking time synchronization using w32/tm

When you enter the command
"w32tm/stripchart/computer:<destination>[/period:<time>]dataonly][/samples:<number>]",
you will see a diagram that displays the deviation (offset) of the computer currently in use to
the specified computer.

Command switches	Meaning
computer:<destination>	The computer used as the base for the deviation measurement.
	Domain controller "DC1" is the target in the example shown below.
period:<time>	Time in seconds between updates. The default value is 2 seconds.
dataonly:	Show only data and no graphics.
samples:<number>	Stops sampling after specified number of time samples. If this value is not specified, time samples will be collected until you press the "Ctrl-C" key shortcut.

Example: Check time synchronization

1. In the Window Start menu, select the menu command **Start > Programs > Accessories > Command Prompt**.

2. Enter the following command in the dialog box:
   w32tm /stripchart /computer:<Computername>
   Example:

   – w32tm /stripchart /computer:DC1
     A diagram indicating the time difference between the computer that is currently in use and domain controller "DC1" is produced.

Monitoring the central plant clock

The SICLOCK function can be monitored using a binary alarm output. For information on parameterizing this output, refer to the SICLOCK documentation.

Configure a priority "16" alarm for monitoring this output in a user program on an automation system.
For further information on configuring the alarm, refer to the *PCS 7 Process Control System; Operator Station* Configuration Manual.

Further information

- Internet: www.microsoft.com, subject: "Synchronizing the time using the Windows time service in Windows XP (http://support.microsoft.com/kb/307897/en)"
- *SICLOCK; SICLOCK TC 400* Operating Instructions
- *SICLOCK; SICLOCK TM* Manual

Glossary

CEDST

Central European Daylight Saving Time

Central plant clock

An central plant clock receives a time signal from an external clock and transfers it to the terminal bus or the plant bus.

CET

Central European Time

Clock, external

External clocks synchronize a plant with the aid of externally received time signals, e.g. the radio signal DCF77 or the satellite based GPS signal.

Cooperative time master

A cooperative time master takes over the role of time master only when it no longer receives time signals from the active time master.

DCF 77

Radio reception of the atomic clock in Braunschweig for operation in central Europe

Domain controller

A domain controller is a server that regulates and manages the authentication and authorization of the computers and users.

GMT

Greenwich Mean Time

GPS

Global Positioning System

Local time

The local time is actual time in the respective time zone.

Passive time master

A passive time master takes over the function of the active time master if the active time master should fail.

RTC (Real Time Clock, hardware clock)

RTC is the internal, battery-operated clock of a PC. This clock continues to run even if the PC is switched off and it has the precision of a quartz clock.

Stratum, strata

A stratum is a hierarchy level within time synchronization. Within a stratum, the time is the same for all components.

- The time basis (precise reference time) within the entire system is designated as stratum 0.
- Components that are directly linked to the time basis are designated as stratum 1.
- Any component within a stratum (n) that causes a time difference generates a new time level stratum (n+1). The digit next to "stratum" indicates the number of time levels between the time basis (stratum 0) and a stratum (n).

Time master

The time master is responsible for distributing the time signal within time synchronization. It forwards the time signal to the PCS7 components that have been configured as time slaves.

The following time master types are available:

- Active time master
- Cooperative time master
- Passive time master

Time slave

The time slaves are PCS 7 components that receive time signals from the time master and thus set their own clock.

Time synchronization

With time synchronization, the date and time of all time-dependent components are unified by a time master.

UTC (Universal Time Coordinated)

UTC is a time basis specified by atomic clocks. It does not take daylight saving time into account.

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